Chapter 1   Introduction

"The difference between what we are doing and what we are capable of doing would solve most of the world's problems."   *-- Mahatma Gandhi*

1.1 Purpose of study

As we move into the 21st Century, we do so in a world of significant technological progress, industrialization, and globalization. Our current standard of living is based upon these drivers of modern progress. Energy systems supply power to our homes, places of work, and general environment so we no longer need to be concerned about how to generate light, power our computers and TVs, and heat or cool our living, working, and recreational environments. When we become ill, we find an abundance of modern drugs that can ease or cure our suffering, maintaining or improving our physical and emotional well-being. Global financial and commodity markets hum to the tune of trillions of dollars a day to supply our investment and consumption needs. The agricultural sector, through mechanization and other technological and biological advances, has been able to supply our growing sustenance requirements. Telecommunications systems have enabled friends, families, businesses, organizations, and governments to communicate verbally, as well as visually, across thousands of miles. Combine this with our modern transportation systems, and we remove the notion of the frontier. Even the deepest oceans are now being explored by scientists.

Having achieved such enormous progress, why then should we be concerned about the future of humankind on a global scale? The answer is quite simple; just over one billion people have any meaningful access to the resources and quality of life described above. The rest of the world's population - some five billion people who live in less developed regions - have only a taste of what this lifestyle might be like (Durning 1992; 1994; UNDP 2003). Such inequality is leading towards a world of growing disparity between industrialized and developing nations. In effect, the communities of less developed regions are held captive to the needs and wants of industrialized nations, whose living and consuming habits are in many ways

condemning billions of people to a lower (material) quality of life. Put simply, if each member of the global community were to live the lifestyle of the average American, holding technology constant, we would need the resources of four more planet Earths (Wilson 2002). It is clear that a global drive to reach the Westernized view of the good life, without a drastic change in production processes and consumption patterns, will soon bring us up against ecological limits, forcing us to rethink what we mean by a secure and fulfilling lifestyle.

These introductory paragraphs present a highly simplified and polarized view of the world in which there are those who *have* and those who *have not*. While this might well be the case at the extremes, there is clearly a continuum of positions in between. The central argument of this thesis is that if we are interested in the well-being of current and future generations, we should not only be *concerned* for the future of the world, we should be actively searching for new ways to enable individuals, communities, and nations to live a sustainable life.

Hence, this research arises out of a concern for the global future. If present trends continue and the structural forces driving them remain substantially unchanged, there is a strong possibility that within a few generations the world will be incapable of sustaining the human population at an adequate level of material well-being and health, and that it will lack sufficient and equitable opportunities for the realization of human potential. These trends include persistent (and often growing) inequalities between and within nations, and persuasive evidence that we are living beyond our ecological means.

Further, the social and political environment in which policy responses to these trends must be made is a difficult one. It is defined by globalization and rapid technological change - a set of conditions that shortens the necessary response time for policy, restricts national policy options, and possibly exacerbates distributional inequality and ecological damage.

The satisfaction of human needs and aspirations in the major objective of development. The essential needs of vast numbers of people in developing countries for food, clothing, shelter, jobs - are not being met, and beyond their basic needs

these people have legitimate aspirations for an improved quality of life. A world in which poverty and inequity are endemic will always be prone to ecological and other crises. Sustainable development requires meeting the basic needs of all and extending to all the opportunity to satisfy their aspirations for a better life. Living standards that go beyond the basic minimum are sustainable only if consumption standards everywhere have regard for long-term sustainability. Yet many of us live beyond the world's ecological means, for instance in our patterns of energy use. Perceived needs are socially and culturally determined, and sustainable development requires the promotion of values that encourage consumption standards that are within the bounds of the ecological possible and to which all can reasonably aspire. Meeting essential needs depends in part on achieving full growth potential, and sustainable development clearly requires economic growth in places where such needs are not being met. Elsewhere, it can be consistent with economic growth, provided the content of growth reflects the broad principles of sustainability and non-exploitation of others. But growth by itself is not enough. High levels of productive activity and widespread poverty can coexist, and can endanger the environment. Hence sustainable development requires that societies meet human needs both by increasing productive potential and by ensuring equitable opportunities for all. An expansion in numbers can increase the pressure on resources and slow the rise in living standards in areas where deprivation is widespread. Though the issue is not merely one of population size but of the distribution of resources, sustainable development can only be pursued if demographic developments are in harmony with the changing productive potential of the ecosystem. A society may in many ways compromise its ability to meet the essential needs of its people in the future - by overexploiting resources, for example. The direction of technological developments may solve some immediate problems but lead to even greater ones. Large sections of the population may be marginalized by ill-considered development.

1.2 Research Objectives

This research aims to encourage a way of thinking that supports the creation of policies for sustainable development. The research has two distinct strands, one that is general and one that is specific. The first considers the theoretical, historical, and

political foundations of sustainable development and approaches the subject in a trans disciplinary manner - i.e., it is not constrained by disciplinary boundaries. It also articulates and develops a series of organizing frameworks through which policy interventions and instruments for sustainable development might be designed and integrated. The outcome of the first strand is the creation of a multidimensional approach towards understanding and acting upon sustainable development.

The second strand applies the concept of sustainable development to transportation, with an emphasis on the government's role in achieving sustainable transportation. By pulling together the organizing frameworks of sustainable development, a sustainable transportation decision-support framework is created. In an effort to understand the potential gaps between the current and what is considered by the author to be a more sustainable approach to transportation planning and decision-making. This report also comprises of the case studies of public transport system in India evaluating in terms of sustainability.

The research is guided by the following three propositions:

- ❖ Sustainable transportation is directly linked to, and must be conceptualized within, the broader framework of sustainable development;
- ❖ The field of sustainable transportation is sufficiently understood for its objective to be pursued through transportation legislation; and
- ❖ The proposed sustainable transportation decision-support framework provide with a road map for developing policy that will move the transportation system towards sustainability.

"*The major problems of the world today can be solved only if we improve our understanding of human behaviour*" (Skinner 1974).

This chapter begins by defining human needs from both a philosophical and psychological perspective and shows how these relate to the idea of human development.

In addition to identifying a framework to consider human needs, it addresses the question of equity - a fundamental component of sustainable development. The discussion focuses on the appropriate role of government in ensuring that human needs are met in an equitable manner.

2.1 Concern for Global Future

In 1987, the World Commission on Environment and Development (WCED) published *Our Common Future*, which again placed 'human needs' at the centre of concerns for 'sustainable' development.

"*Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:*

☐ *the concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and*

☐ *the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs*" (WCED 1987, p. 43).

The WCED conceptualization of sustainable development, built upon the development vision articulated in *What Now: Another Development*, made an influential case for "*the need to integrate economic and ecological considerations in*

decision making" (WCED 1987, p. 62). The basic notion was that social and economic development must not undermine the natural environment upon which they are based. Hence, sustainable development "*requires views of human needs and well-being that incorporate such non- economic variables as education and health enjoyed for their own sake, clean air and water, and the protection of natural beauty*" (ibid, p. 53).

A key argument of this report is that the satisfaction of needs should drive economic and (democratic) political systems. With regards to the political system, we satisfy our political needs by voting for the politician or political party that is most likely to support our lifestyle and beliefs. When the votes are aggregated, the candidate/party whose views align more closely with the needs and wants of society should be elected. Indeed for many, free markets and democracy are intertwined.

This demand-side notion that our needs drive economic and political systems raises an interesting question about how change is likely to occur in practice. If we make decisions based upon our individual needs, then it can be argued that a society is only likely to address unsustainable activities once the individual is negatively affected.

Before discussing economic and political systems further, it is important for us to take a closer look at the concept of basic human needs. The above discussion - as with many discussions on sustainability - uses the term 'human needs' with a limited explanation of what this might actually encompass.

To adequately address the topic of human needs, we first turn to the domain of philosophy and then to psychology. The former looks at the question of the *life worth living* and the latter, emerging from philosophy, attempts to formulate the fundamental *needs* which motivate human behavior towards this goal. Understanding the various philosophical meanings of a life worth living is important, since it will ultimately enrich our view of basic and higher human needs.

2.1.1 Philosophies of Ethics and the Good Life

The philosophical meaning of the term *ethics* is far broader than society's use of the term today, which is to delineate the moral choice between right and wrong behavior. Sahakian and Sahakian (1966) argue that in the systems of many philosophers the notion of the good life - i.e., the life worth living, or the life that is satisfying - was seen as being more important than moral choice.

The ancient Greek philosophers believed that the good life resides in *virtue*. Socrates (469-399 B.C.) was interested in *true virtue*, which, like good health, is the same for everyone. He argued that virtue is knowledge and that a person who knows what is right will do it, since no human ever desires what is bad. His notion was that if people acted inappropriately, by stealing, lying, hating, etc., it was because they did not understand the full consequences of their actions. Hence, knowledge frees a person from ignorance and enables him/her to make right decisions. Socrates believed that virtue is identical to happiness and that a person who acts for his/her own good will ultimately be happy and live a good life.

In contrast, Plato (427-347 B.C.) identified four central virtues present in the ideal state or person - *justice*, *wisdom*, *courage*, and *moderation*. Plato believed that individual human beings are not self-sufficient and, therefore, to overcome life's challenges, humans gather into communities for the mutual achievement of common goals. The *ideal state*, then, consists of three distinct classes - *rulers*, *soldiers* (these two classes are known as the guardians), and the *people*. Collectively, the guardians are those individuals responsible for the governance and protection of the state. Plato then assigned three of the virtues to a class of society - i.e., wisdom to rulers, courage to soldiers, and moderation to the people. If each class performs its own role holding true to its virtue, the city/state will exhibit the harmony that is the virtue of justice. Hence, the four virtues ensure society works together for the common good, or the *well-being*, of the city/state.

Aristotle (384-322 B.C.), a student of Plato, also disagreed with Socrates in regards to his belief that *knowing* what is right means that a person will *do* what is right. Aristotle believed that an individual's *weakness of will* affects his/her moral conduct,

meaning that acts of wrongdoing can be made with the full knowledge of the potential consequences. He believed that the attainment of the good life or happiness was the result of *Self-Realizationism* – the ability to realize one's potentialities, character, or personality (Sahakian and Sahakian 1966). To Aristotle, the person who has the greatest potentialities and is able to actualize this potential has the brightest prospect of happiness. Conversely, the person whose potential remains unfulfilled will ultimately be frustrated and unhappy. Aristotle believed virtue was found in *habitual moderation* and listed twelve important virtues, which he placed between extremes. The concept is that a rational person will always exhibit moderation and will avoid extreme behavior.

Aristotle saw friendship as an important virtue and feature of the good life, for "*without friends no one would choose to live, though he had all other goods*" (Aristotle, 350 B.C., Book VIII, Chapter 1).16 Along with the cultural traditions of ancient Egyptians, which taught that wealth does not bring happiness, this is one of the earliest written recognitions that wealth and material goods do not lead to the good life and happiness.

Two other systems of philosophy that are worth mentioning are *hedonism* and *utilitarianism* (Sahakian and Sahakian 1966). Hedonism, in an ethical sense, is most closely associated with the ancient Greek philosopher Epicurus (342-270 B.C.). It is a system of philosophy in which the primary aim of individuals is to maximize pleasure or happiness. Hence, the search for pleasure and the avoidance of pain are its primary objectives. There are several types of hedonism; some focus on momentary sensual pleasures, while others focus equal attention on spiritual pleasures as well. Utilitarianism shares some features with hedonism. The hedonistic utilitarianism of Jeremy Bentham17 and John Stuart Mill18 maintains that all moral judgments should aim to achieve the greatest good for the greatest number - this is also known as the greatest happiness principle. If the philosophy is applied to an individual, it follows that a person will select the solution that provides him/her with the greatest happiness or utility.

Utilitarianism is a normative theory to the extent that it focuses on understanding which human actions are right and which are wrong.

The above discussion highlights a broad range of ways in which we can consider what constitutes the *good life*. For example, one could argue that the good life or well-being can be achieved through:

☐ simply taking actions which you know to be right (Socrates);

☐ knowing your place in society and acting in accordance with the virtue (i.e., wisdom, courage, or moderation) of your class (Plato);

☐ the self-realization of your potentialities, character, and personality and through habitual moderation (Aristotle);

☐ maximizing pleasure and happiness by searching for pleasure and avoiding pain (Epicurus); or

☐ making moral decisions which aim to achieve the greatest good for the greatest number of people (Bentham and Mill).

Hence, an individual's view of what constitutes the good life will have a strong influence on his/her behavior within society, including his/her actions within economic and political systems.

2.1.2 The Psychology of Human Needs

This section presents a basic discussion of how needs or desires motivate an individual's behavior. By understanding the psychology of human behavior, it will be possible to develop strategies/programs that will not only be more effective in communicating the vision of sustainable development to the public, but will assist society in adopting new behaviors that will help realize a more sustainable future (McKenzie-Mohr 2002). Or to put it another way, devising sustainable strategies without taking the psychological basis for behavior into account is not likely to be very successful.

The concept of human needs has traditionally been used in two distinct ways (Ryan 1995). The first and most common definition of a need is connected to virtually any *motivating force*, such as one's desires, goals, wants, or values. Within this group, the term *need* is also used in a loose manner in expressions such as "I need new shoes" or "I need a new automobile." When used in such a way, an individual is

using the term 'need' to express a strong desire. The second definition of a need refers to *physiological needs* - the nutrients or conditions which are essential for our survival as humans, such as food, water, and shelter. Using these two definitions, it is possible to generate endless lists of needs, especially if the loose definition of a need is invoked. However, if the criterion of a need is focused on necessity for growth, the potential list of needs is rapidly reduced.

Human needs or desires motivate behavior. Boeree groups the concept of *motivation* into four broad areas:

☐ **Biological motivations** - those which are organically driven, such as our need for food and water, and hedonistic needs such as pain-avoidance and pleasure;

☐ **Social motivations** - the need for acceptance, attention, and approval which influence forms of self-esteem;

☐ **Personal motivations** - those which are based upon the experiences of the individual resulting in habitual behavior, defense mechanisms, and personality styles; and

☐ **Higher motivations** - which come in two forms:

1. *competence motivation* - a desire to learn, attain competence/mastery, and be creative; and

2. *altruistic motivation* - a concern for society, and a need for compassion and love.

The failure to differentiate the various types of human needs has created confusion in the realm of politics, especially when it comes to discussions about sustainable development. While it is possible to scientifically define biological motivations (our need for food and water, etc.) the other types of motivation cannot easily be defined. The problem is further compounded by the fact that within the field of psychology, *behaviorists* (e.g., B. F. Skinner)*, psychoanalysts* (e.g., Sigmund Freud), and *humanists* (e.g., Abraham Maslow), for example, approach the topic of human needs from different perspectives. Hence, "*human needs are discerned differently according to the ideological and disciplinary lens of the viewer*" (Max-Neef et al. 1989, pp. 17-18).

When thinking about how human needs change, it is possible to do so in a *developmental* (infant to adult) and *non-developmental* (functioning individual) context. Sigmund Freud was the first psychologist to advance the theory that human needs are the neurological representation of physical needs, and that these needs change as a human develops. Freud's developmental ideas were later advanced by Erik Erikson who gave them an intuitive nature and basis in reality. Erikson (1963) developed eight stages to the human life span, from infancy to late adulthood.31 During each stage of development it is clear that an individual's needs change. For example, a baby's needs are entirely satisfied by its parents, but as the baby transitions to a child, to an adolescent, and then finally to an adult, he/she will develop an identity and take on more responsibility for satisfying his/her own needs. Hence, human needs change as we transition through our various stages of physiological and psychological development.

An alternative view to Freud and Erikson is presented by Abraham Maslow. Instead of trying to understand how needs change as an individual *grows*, Maslow (1943) developed a theory of human motivation which can be used to analyze the *functioning individual*. Maslow's theory consists of a hierarchy of needs (Figure 2.1) and is based upon the notion that as an individual's lower level needs are satisfied, new needs emerge that require fulfillment.

Figure 2.1: Maslow's Hierarchy of Needs
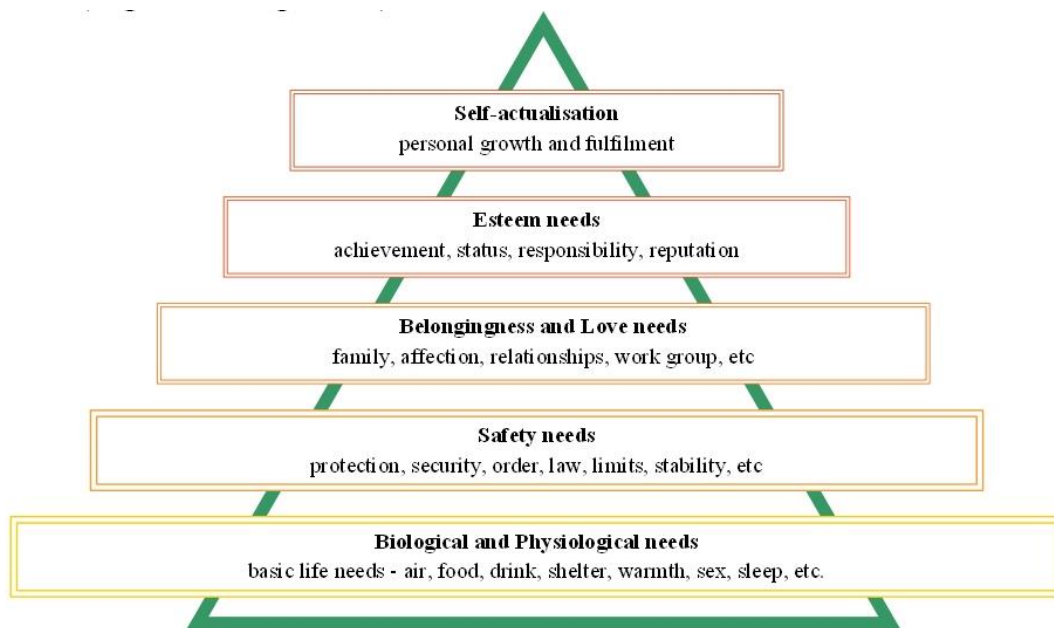
First are the *Physiological* needs, the fundamental biological need for homeostasis, which includes the need for oxygen, water, vitamins, minerals, and also non-consumption needs such as sleep and pain avoidance. Second are the *Safety* needs; once the physiological needs are relatively well satisfied, an individual will become a safetyseeking mechanism, looking for safe accommodation/shelter, stability, and protection. Having adequately satisfied the physiological and safety needs, a third layer of needs emerges. These are the *Belonging* needs - the need for love, affection, and belongingness.

Next are the *Esteem* needs, which are classified in two subsidiary sets: [1] the need for strength, achievement, adequacy, confidence, and freedom (known as the higher needs); and [2] the need for prestige, recognition, attention, and appreciation (known as the lower needs). The fifth need is for *Self-actualization* and is different from the four other needs. This stage refers to the need for self-fulfillment, the desire for an individual to achieve self-actualization, to reach his/her potential (whatever that potential might be) - e.g., an artist, musician, teacher, etc. Maslow argues that people who have satisfied all five levels of need can be called "*basically satisfied people, and it is from these that we can expect the fullest (and healthiest) creativeness*" (Maslow1943,p.383).

While psychologists disagree with certain aspects of Maslow's theory, it does provide us with a useful way of thinking about how environmental and societal factors might influence an individual's behavior. This is especially important when considering differences in the needs of people in developed versus developing nations. In addition to using Maslow's hierarchy of needs to assess humans, researchers have applied this theory to a variety of research areas. An interesting example is a paper by Collins et al. (1997) which expands Maslow's hierarchy of needs into a framework for approaching the human dimension in ecosystem management.

In contrast to Maslow's theory, Max-Neef et al. (1989) argue that all human needs must be understood as an inter-related and interactive system.34 Apart from sustenance needs, which are essential to human life, there are *no* hierarchies in this system. Max-Neef et al. question the lack of any real discussion of the difference between human *needs* and the *satisfiers* of those needs. In particular, they ask *what* the fundamental needs are and *who* determines these? To help answer this question,

Max-Neef et al. present a 36 cell matrix which organizes human needs into existential (*being*, *having*, *doing*, and *interacting*) and axiological (*subsistence*, *protection*, *affection*, *understanding*, *participation*, *idleness*, *creation*, *identity*, and *freedom*) needs (Table 2.3). Within this framework, needs are seen as having a two-fold character: as deprivation and as potential.

Table 2.3: Matrix of Needs and Satisfiers

Fundamental Human Needs	Being (qualities)	Having (things)	Doing (actions)	Interacting (settings)
subsistence	physical and mental health	food, shelter work	feed, clothe, rest, work	living environment, social setting
protection	care, adaptability autonomy	social security, health systems, work	co-operate, plan, take care of, help	social environment, dwelling
affection	respect, sense of humour, generosity, sensuality	friendships, family, relationships with nature	share, take care of, make love, express emotions	privacy, intimate spaces of togetherness
understanding	critical capacity, curiosity, intuition	literature, teachers, policies educational	analyse, study, meditate investigate,	schools, families universities, communities,
participation	receptiveness, dedication, sense of humour	responsibilities, duties, work, rights	cooperate, dissent, express opinions	associations, parties, POW*, neighbourhoods
leisure	imagination, tranquillity spontaneity	games, parties, peace of mind	day-dream, remember, relax, have fun	landscapes, intimate spaces, places to be alone
creation	imagination, boldness, inventiveness, curiosity	abilities, skills, work, techniques	invent, build, design, work, compose, interpret	spaces for expression, workshops, audiences
identity	sense of belonging, self-esteem, consistency	language, religions, work, customs, values, norms	get to know oneself, grow, commit oneself	places one belongs to, everyday settings
freedom	autonomy, passion, self-esteem, open-mindedness	equal rights	dissent, choose, run risks, develop awareness	anywhere

*POW - Place of worship

Source: Max-Neef et al. (1989, p 33).

Using Max-Neef's classification of human needs (Table 2.3), we find that food and shelter are not seen as needs, they are instead *satisfiers* of the fundamental need for subsistence. Likewise, having the ability to express opinions, to cooperate, or to dissent are satisfiers for the need to participate. In addition, there is no one-to-one correlation between needs and satisfiers. Needs may require more than one type of satisfier to be met and, conversely, a satisfier may help realize several needs at once.

From this framework, Max-Neef et al. make the following two claims. *"First: Fundamental human needs are finite, few, and classifiable. Second: Fundamental human needs … are the same in all cultures and in all historical periods. What changes, both over time and through cultures, is the way or the means by which the needs are satisfied"* (Max-Neef et al. 1989, p. 20).

What Max-Neef et al. argue is that it is the economic, social, and political *systems* which adopt different methods for the satisfaction of the same human needs. Hence, a critical aspect to their theory is that individuals, groups, and cultures develop the *actions* and *value systems* that will be used to realize their needs.

An important outcome of the above discussion is that individuals, communities, and societies decide upon the satisfiers to their needs. This is critical since it enables us to reinterpret the concept of poverty, which has traditionally been defined by economics with reference to income. Max-Neef et al. argue that *"we should speak not of poverty, but of poverties. In fact, any fundamental human need that is not adequately satisfied, reveals a human poverty"* (Max-Neef et al. 1989, p. 21). Hence, it follows that poverty can be found in all nine of the axiological needs, e.g., poverty of sustenance, of protection, etc. These poverties lead to confusion, isolation, frustration, and general psychological distress, which ultimately manifest themselves through *"pathologies"* such as war, racism, hunger, etc. Max-Neef's insights into the human condition contain a valuable message. If we rely only on an economic frame of reference, we will ultimately not be able to satisfy our needs. Therefore, our research, strategies, and policies need to be developed using a *transdisciplinary* approach.

In 1991, Doyal and Gough published *A Theory of Human Need*, in which they attempt to identify *"those characteristics of satisfiers which apply **to all cultures**"* (Doyal and Gough 1991, p. 157, emphasis added). The basic premise is that these 'universal satisfier characteristics' are *"those properties of goods, services, activities and relationships which enhance physical health and human autonomy in all cultures"* (ibid, p. 157). Doyal and Gough argue that physical survival (i.e., good health) and personal autonomy (i.e., the ability to act in a self-directed manner and to participate) constitute the most basic human needs, and they *"must be satisfied to some degree before actors can effectively participate in their form of life to achieve*

any other valued goals" (ibid, p. 53). The universal satisfier characteristics are described as being a bridge between universal human needs and those which are culturally and socially determined. Thus, Doyal and Gough (1991) name them 'intermediate needs,' and their list of these needs includes the

need for:

☐ food and water and an appropriate nutritional intake;

☐ housing and adequate shelter, basic services, and space per person;

☐ a non-hazardous working environment;

☐ a non-hazardous physical environment;

☐ appropriate and accessible health care;

☐ security in childhood;

☐ significant primary relationships;

☐ economic security;

☐ physical security;

☐ appropriate and accessible education; and

☐ safe birth control and child-bearing.

While the above list may not be fully comprehensive and is somewhat ambiguous, a fact acknowledged by the authors, it does provide a basis from which the satisfaction of (intermediate) needs across cultures can be assessed. By developing a series of indicators to measure intermediate needs, Doyal and Gough were able to obtain some insight (which was somewhat hampered by the availability and reliability of data) into the difference between the satisfaction of basic needs in developed and developing nations. Their analysis revealed that people living in affluent nations are more likely to be able to satisfy their basic needs than people living in poor nations. However, it also showed that there are differences within these groups as well.40 One of the most salient conclusions from their analysis is that the relationship between mean income and need satisfaction is complex and nonlinear. It depends on the distribution of wealth within and between nations and between genders. Addressing these distributional issues will need to be assessed within the context of individual freedom and state control. Hence, there needs to be a willingness on the part of all nations to engage in discussions and the analysis of the connection between freedom, regulation, and control if and when radical changes to our social and physical systems become necessary (Haland 1999).

A final concept, which provides a more condensed view of human needs than that presented by Max-Neef et al. and Doyal and Gough, is self-determination theory (SDT). SDT is a "*macro-theory of human motivation concerned with the development and functioning of personality within social contexts*." Therefore, it is *not* concerned with physiological needs, such as our desire for sustenance.

SDT is based upon the assumption that [1] people (as active organisms) have an instinctive tendency for psychological growth and development, and [2] that this human tendency requires nutrients and support from the *social environment* to function effectively, without which psychological growth will not occur. Hence, SDT predicts human *behavior*, *experience*, and *development* by studying the active organism (the individual) within its social context.

In summary, Figure 2.2 attempts to provide a visual representation of the conceptual framework developed above. It shows that throughout our lifetime we are at the center of significant forces. The top arrow represents the influence that history, culture, and our economic, social, and political systems have on shaping the satisfiers to our needs - which are displayed to the left of the center arrow. We internalize these influence through *learning*, which is guided by our families, friends, media, markets, etc. The bottom arrow represents evolution, genetics, and biology that influence our *physiological* needs such as sustenance. Our temperament, instincts, health, etc., all stem from our genetic make-up, which tells us how to instinctively respond to a situation (emotionally and physically) or signals (e.g., through neurotransmitters) when we need food, water, or rest. To the right of the figure is the good life. The good life is culturally defined and will influence each individual through those factors represented by the top arrow.
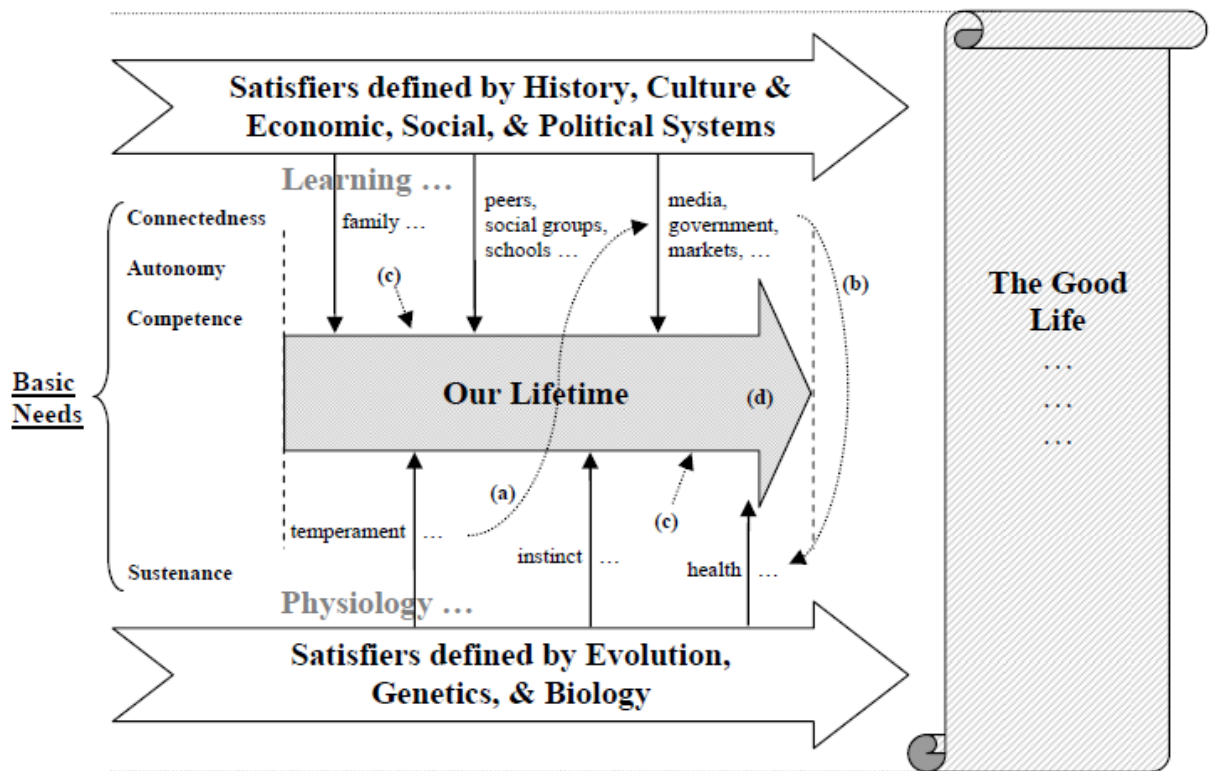
Figure 2.2: Visualization of Human Needs, the Satisfiers of Those Needs, and One's Overall Satisfaction with Life

The (a) and (b) arrows indicate how our physiology influences learning and vice versa. The (a) arrow represents how our temperament is likely to influence how we react to an advertisement or the loss or gain of money on the stock exchange. For example, if a person has an aggressive temperament, the loss of money might result in a violent outburst of aggression. The (b) arrow represents how advertisements or government information might have a positive or negative effect on our health. For example, if a series of advertisements entices an individual to eat fast food for a long period of time, that person is likely to face health problems due to a poor diet. The (c) arrows represent random physiological or experiential influences. For example, a person might be involved in a car accident or hear an influential thinker present a new theory, both of which might influence his/her life in some unknown manner. The last arrow shown on the diagram is (d), which represents our own choices. This refers to our own desire to live *our* life *our* way in a self-directed manner.

2.1.3 Human Development

The objective of this section is to transition from philosophy and the psychology of human motivation to the more tangible reality of *human development* as described by the United Nations (UN). The connection between these concepts is the idea that human development is the result of an intrinsic motivation to realize one's full potential and to live a good life. The following discussion examines the definition and drivers of human development and assesses whether the UN's current development paradigm has the potential to move us towards a high level of subjective well-being (SWB).

The 1995 UN Human Development Report (HDR) defines *human development* as a "*process of enlarging people's choices*" (UN 1995, p. 11). More specifically, it discusses the following three core choices (or opportunities) for people:

[1] to lead a long and healthy life;

[2] to acquire knowledge; and

[3] to have access to sufficient resources to be able to obtain a decent standard of living.

Other opportunities described as being highly valued by society include economic, social, and political freedom, and opportunities for creativity, productivity, enjoying personal self respect, and for guaranteed human rights. Hence, human development is seen as having two sides. The first is the establishment of human *capabilities*, such as improved health and knowledge. The second is how people put these acquired capabilities to use, such as being active in cultural, social, and political affairs. The UN's use of the term 'choices' in defining human development is deliberate, since it raises the question of whether a person has the opportunity to improve his/her current situation.

In an effort to quantify dimensions of human development, in 1975 the UN established the Human Development Index (HDI), which was first published in the (somewhat controversial) Human Development Report of 1990 (UN 1990).

The HDI consists of three indicators:

[1] life expectancy at birth;

[2] educational attainment; and

[3] real GDP (or income) (UN 1995).

The HDI is obtained by taking a simple average of the three indicators. For example, if a country were to obtain an HDI of 1, then all of its inhabitants achieve an average

life span of 85 years, and everyone has access to education and a decent level of income.

While the 1995 Human Development Report focuses on describing the HDI, it also provides a critique of the index. Its main comments refer to the lack of any measure of political freedom, cultural values, or environmental sustainability. There are also concerns about the choice of variable used to measure the three indicators, the quality of the data upon which the indicators are based, and the treatment of income, which some argue should be removed since it is a means and not an end.

Today, the UN uses four additional indices to capture gender imbalances and income disparities across nations (UNDP 2003). The five UN human development indices are:

1. **HDI** (Human Development Index);

2. **HPI-1** (Human Poverty Index for developing countries) -- this index measures *deprivations* in the three human development indicators of the HDI;

3. **HPI-2** (Human Poverty Index for selected OECD countries) -- this index measures deprivations in the same manner as HPI-1, but also includes social exclusion through a long-time unemployment rate;

4. **GDI** (Gender-related Development Index) -- this index adjusts the HDI to reflect inequalities between men and women; and

5. **GEM** (Gender Empowerment Measure) -- this is an entirely new index which measures female participation in *political* and *economic* decision-making, and female power over economic resources.

INTERNATIONAL HUMAN DEVELOPMENT INDICATORS

India

Country Profile: Human Development Indicators

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National Human Development Reports for India

Human Development Index	Ranking 136
Health	Life expectancy at birth (years) 65.8
Education	Mean years of schooling (of adults) (years) 4.4
Income	GNI per capita in PPP terms (constant 2005 international $) (Constant 2005 international $) 3,285
Inequality	Inequality-adjusted HDI value 0.392
Poverty	MPI: Multidimensional poverty index (%) 0.283
Gender	GII: Gender Inequality Index, value 0.610
Sustainability	Carbon dioxide emissions per capita (tonnes) 1.5
Demography	Population, total both sexes (thousands) 1,258,351.0
Composite indices	Non-income HDI value 0.575
Innovation and technology	Fixed and mobile telephone subscribers per 100 people (per100 people) 64.3
Trade, economy and income	Income index 0.515
Footnotes	

To put the problem of sustainable development in simple terms, if a society is unable to fulfill its basic human needs, and as a consequence continues to divest in human development and degrade the environment, it is difficult to envision a future in which its development will be sustainable. "*The sustainability problem is a result of individual and collective human behaviour. It cannot be treated as an economic or technical problem, without considering the mechanics that intervene on the behavioral side of it*" (Pol 2002, p. x). Hence, government, society (i.e., communities and individuals), and industry have a responsibility to promote values that center on innate human needs, the satisfaction of which should lead to good physiological and psychological health. Further, each stakeholder also needs to promote levels of consumption that do not exceed ecological limits and set a standard of living to which all can aspire. Ultimately, turning our focus to meeting human needs is likely to *"make fewer demands on our environmental resources, but much greater demands on our moral resources"* (Brown 1981, p. 359). In the end, the challenge facing society is how to reconcile the void between individual human needs on the one hand and the sustainable development of social and physical systems at the local, national, and global level on the other.

2.2 Social Justice, Inequality, and the Social Contract between the Governed and the Government

"The test of our progress is not whether we add more to the abundance of those who have much; it is whether we provide enough for those who have too little"
  (Franklin Delano Roosevelt, Second Inaugural Address, January 20, 1937).

An important conclusion drawn above is that government should act as a trustee to ensure that basic human needs are met in an equitable and just manner. However, governments cannot provide the whole answer; competitive markets will also continue to play a vital role in meeting human needs. The challenge is to find a tolerable balance between government regulation and economic (and other forms of) freedom.

Given the above discussion, a critical question remains: *how should we operationalize the social contract?* Further, if government is to act as a trustee, how should it interact with the public?

Ashford and Rest (2001) provide some useful answers to these questions. In particular, they argue that the perceived and actual role of government in public participation is crucial, as is the role adopted by the stakeholders.

"Specifically, what is important is whether the government sees itself and is seen as (1) a trustee of community/stakeholder interests, or alternatively (2) as a mediator or arbitrator of conflicting interests in the community or stakeholder group. The roles adopted by the participants of community and stakeholder involvement processes are likewise important, specifically the participant dynamics that foster majoritarian or utilitarian outcomes, versus communitarian outcomes. Both sets of roles can affect the process and outcomes of public participation efforts. In other words, the role of government and the tenor of community or stakeholder participation are codeterminative of success – which we define, in large measure, as enhancing fairness, justice, and empowerment for the most [adversely] *affected.*

In order for the government to act in a trusteeship capacity, it must be committed to justice and fairness in the Rawlsian sense - i.e., it must first and foremost encourage or allow those activities that provide relatively greater advantage to those individual members or groups who are relatively worse off to begin with ... . In a political climate where stakeholder involvement is encouraged to legitimize conflict resolution or the parceling out of scarce agency resources, government can easily abdicate its trusteeship role in favor of a more utilitarian approach to problem solving. The result is often a continued polarization of

various community groups and members.

...

To the extent that government sees and presents itself as a convener or mediator of opposing interests, government itself may foster utilitarian, rather than communitarian values and outcomes. Conversely, where government presents itself as a guardian of the disadvantaged, community participation mechanisms that protect minority views and interests by addressing imbalances of power are encouraged. The community members themselves may step out of their roles as representatives of narrow community interests, and address issues of fairness on a broader scale. Thus, vehicles for public participation and stakeholder involvement must be seen within this broader perspective in order to gauge their accomplishments" (Ashford and Rest 2001, p. VII-9).

The research undertaken by Ashford and Rest (2001) indicates that the outcome of discourse between government agencies and the public depends on the roles adopted by each. To help visualize the interactions between government and society, they developed a matrix that presents the likely outcomes under the different government/stakeholder positions (Table 2.5).

In the left column of Table 2.5, the two roles of government are indicated: [1] the government acts as a *trustee* of stakeholder interests; and [2] the government acts as a *mediator* of conflicting interests between/among stakeholders. For the stakeholders, two (somewhat idealized) positions are presented: [1] *utilitarianism* - in which stakeholders seek to maximize their own utility; and [2] *communitarianism* - in which stakeholders act for what *they* perceive as the greater social good. Further, a distinction is made between the *participating* stakeholders, i.e., those actively

involved in public participation efforts, and the non participating public who are also stakeholders.

Table 2.: Types and Outcomes of Interactions between the Government and Stakeholders

GOVERNMENT'S ROLE	UTILITARIAN (Maximizing individual/social benefit)	COMMUNITARIAN (Promoting the 'greater social good')
As a trustee for the affected stakeholders	1. Decision made by government in a trusteeship role on behalf of all the *participating stakeholders*	2. Decision made by government in a trusteeship role on behalf of the stakeholders (mirroring a *normative* consensus, possibly expanding to benefit the larger non-participating public as well)
As a facilitator of utilitarian or majoritarian consensus, or alternative dispute resolution among the stakeholders	3. Stakeholder involvement processes reach a *consensus* or *compromise* among the *participating* stakeholders	4. Idealized stakeholder involvement processes reach *normative* consensus, possibly expanding to benefit the larger non-participating public as well

Source: Adapted from Ashford and Rest (2001, p. VII-14).

If we consider the first row in Table 2.5 - i.e., the government adopts the role of *trustee* - two situations can arise (Ashford and Rest 2001, p. VII-13). First, government acts on behalf of the *participating* stakeholders to promote utilitarian solutions (cell 1). Second, government acts on behalf of *all stakeholders*, including those who are not present, to promote communitarian solutions (cell 2). Likewise, if we consider the second row in Table 2.5 - i.e., the government adopts the role as *facilitator* of compromise or consensus - we see two different situations (ibid, p. VII-13). First, government acts to implement the compromise/consensus reached by the participating stakeholders (cell 3). Second, government acts to implement the normative consensus achieved by stakeholders on behalf of the larger non-participating public (cell 4). As before, the former promotes utilitarian solutions and the latter communitarian ones.

Ashford and Rest (2001, p. VII-15) draw the following conclusions from the matrix:
"*If what is desired is reaching decisions that benefit the larger group of stakeholders (both participating and non-participating), this can be achieved either by government adopting a role as a trustee/decision-maker for the larger group of stakeholders ... [cell 2] or through an idealized stakeholder involvement process facilitated by government ... [cell 4]. This is especially appropriate in environmental justice communities.*
On the other hand, if the participating stakeholders are able or not [able] ... to think beyond their narrow self-interests, stakeholder involvement processes will leave them most satisfied if either the government facilitates giving them what they want through meaningful participation in reaching compromises or resolving disputes ... [cell 3] or if the government serves as a trustee for their interests ... [cell 1]"

Hence, the choice of public participation mechanism should be chosen with care, "*paying special attention to the best way to achieve procedural fairness, procedural competence, and optimal outcome. ... This will necessarily involve a variety of complementary mechanisms, utilizing both community and stakeholder involvement processes*"

To help visualize the implications of Ashford and Rest's (2001) framework, Table 2.6 has been created to show whether the (idealized) roles of government and

stakeholder postures are likely to result in a Rawlsian outcome. The table uses the terms 'Rawlsian outcome,' 'Rawlsian/Non-Rawlsian government,' and 'strong/weak stakeholder postures,' which require some clarification.

A *Rawlsian outcome* is where new legislation, policies, or programs support initiatives that offer greater advantage to individuals or groups who are relatively worse off to begin with.

A *Rawlsian government* refers to a government that is willing and has the capacity to either impose or endorse Rawlsian outcomes. If the stakeholders hold a predominantly utilitarian posture, it is likely that the Rawlsian outcomes will need to be *imposed* upon the stakeholders, which a Rawlsian government may be willing to do. While such a situation appears autocratic, one needs to recognize that utilitarian solutions can result in unjust outcomes that can infringe upon an individual's liberty and rights. Here, the *fundamental assumption* is that Rawlsian outcomes are more likely to be just and fair for all members of society. Hence, if the stakeholders hold a predominantly communitarian posture - which promotes the (perceived) greater societal good - the government is likely to simply *endorse* the solutions agreed upon by stakeholders.

It follows that a *non-Rawlsian government* is either unwilling, or does not have the capacity, to impose Rawlsian outcomes on the stakeholders. Instead, it adopts the position as mediator of stakeholder interests. Under this arrangement, the responsibility for achieving a just and fair society is left to the stakeholders. A *non-Rawlsian government* does not mean that a Rawlsian outcome cannot be achieved; it simply means that government does not act as a trustee for stakeholder interests, and it would take a strong communitarian group of stakeholders to press for a Rawlsian outcome.

Under both the utilitarian and communitarian postures, *stakeholder influence* is idealized as either being *strong* or *weak*. While the influence and ability of stakeholder groups depend upon their size and composition (Olson 1971), we are not concerned with such detail in this hypothetical exploration. For simplicity, we can assume *strong stakeholder influence* means that the stakeholders have the ability to influence government action, and *weak stakeholder influence* means that this is less likely.

When considering Table 2.6, it is helpful to think about specific issues/problems that government and stakeholders might address, such as air pollution. While the ideas

presented in Table 2.6 are hypothetical, they present some valuable insights that can help guide decision-making towards a just and fair society. In effect, the table shows two important outcomes: [1] *a Rawlsian-sympathetic government may not be sufficient to achieve a Rawlsian outcome if the stakeholders adopt a utilitarian posture and the government accedes to their wishes*; and [2] *a non-Rawlsian government can arrive at a Rawlsian outcome, but only if stakeholders adopt a communitarian posture and the government accedes to their wishes*.

If stakeholders adopt a strong or weak communitarian posture, the likelihood of a Rawlsian outcome being reached is good, but of varying likelihood, regardless of whether a government is a trustee or mediator of stakeholder interests. However, if there is a Rawlsian government, a Rawlsian outcome will be more likely (see the upper right cells in bold). In contrast, if stakeholders adopt a strong or weak utilitarian posture the likelihood of a Rawlsian outcome being reached is extremely unlikely or uncertain (see the shaded cells), although not impossible. If the Rawlsian government and utilitarian stakeholders are either both strong or weak, it is difficult to predict the outcome. In all likelihood, the stronger entity will prevail, although the final solution may not satisfy the winning party as a result of hard-won compromises. However, if there is a non-Rawlsian government and strong utilitarian stakeholders, it is very likely that the outcome would be. It should be understood that communitarian stakeholders will not develop a Rawlsian outcome based upon Rawls's (1971) *Theory of Justice*; rather, they are likely to approximate a Rawlsian outcome by pursuing the greater social good (or common purpose or goal). Thus, communitarians are 'likely' to arrive at a Rawlsian outcome from the perspective of shared moral values that stem from the traditions of a community. While it is not possible to know whether, and to what extent, communitarian stakeholders will develop Rawlsian outcomes - since the perception of a 'fair outcome' is likely to differ between communities - one would imagine that their strong emphasis on the 'community' is likely to prevent or minimize the marginalization of disadvantaged groups. For an insightful discussion of the differences between views of liberals (i.e., Rawlsians) and communitarians, see Etzioni (1990).

The value of the framework proposed in this section is that it can be applied to *any*

situation in which government is needed to change or implement new social arrangements (i.e., rules, regulations, laws, or policies) to improve the well-being of society.

2.2.1 Equality of What?

The manner in which equality is defined and evaluated is directly linked to the types of inequalities one is trying to right. This section takes a brief look at the various ways in which equality is considered and how this relates to the broader picture of sustainable development.

The major philosophies of government (or social arrangements), some of which are discussed in the previous section, all support the notion of *equality* in terms of a "*focal variable*" - such as income, wealth, happiness, opportunities, rights, or needs-fulfillment (Sen 1992, p. 2). The basic premise of these theories is that each individual should have *equality of opportunities* in regards to the variable(s) selected (see Rawls's second principle of justice). For example, everyone should have an equal opportunity to gain employment or to have an education. In a world in which everyone's circumstances and abilities are the same, focusing on *equality of opportunity* would suffice. Yet this is not the world in which we live and relying on equal considerations often results in the unequal treatment of the disadvantaged.

In the monograph *Inequality Reexamined*, Nobel Prize winning economist Amartya Sen (1992) raises the question of '*equality of what?*' and links it directly to the consideration of human diversity. In particular he argues that social arrangements (e.g., government policies, laws, etc.) should be assessed in relation to a person's capability to achieve functionings.
Sen's (1992) idea of *functionings* is Aristotelian in origin. He defines *functionings* as the various things that a person has "*reason to value*," such as being well-nourished, avoiding escapable morbidity, etc., to more complex realizations such as having selfrespect or being a valued member of a community (ibid., p. 5). Alkire (2003, p. 5) describes Sen's idea of *functionings* as being "*an umbrella term for the resources and activities and attitudes people spontaneously recognize to be important – such as*

poise, knowledge, a warm friendship, an educated mind, a good job. What is centrally important varies in different places, which is why there is no rigid and inflexible set of specific capabilities – the priorities will have to be set and re-set again and again in different ways."

It follows that an individual's *achieved functionings* are those that the individual has successfully pursued and realized. However, Sen (1992) argues that focusing on achieved functionings (or focal variables) alone is not sufficient. The inherent diversity among individuals - in relation to their external circumstances and psychological and physiological make up - means that the characteristics of inequality tend to *diverge* within the variable under analysis. In other words, differences in the circumstances and abilities of people mean that *equality of opportunity* will not lead to *equal* wealth or happiness, for example. In addition, equality *between* different focal variables may not coincide. "[E]*qual opportunities can lead to very unequal incomes. Equal incomes can go with significant differences in wealth. Equal wealth can coexist with very unequal happiness. Equal happiness can go with widely divergent fulfilment of needs. Equal fulfilment of needs can be associated with very different freedoms of choice. And so on* " (ibid, p. 2). Hence, Sen's core argument is that the "*the basic heterogeneity of human beings*" and "*the multiplicity of variables in terms of which equality can be judged*" are two factors that complicate the idea of equity (ibid, p. 1). This means that a focus on individual functionings (or focal variables) does not necessarily incorporate an individual's *freedom* to achieve. Hence, Sen introduces the concept of *capability* to describe an individual's freedom to achieve 'valuable' functionings. "*It represents the various combinations of functionings (beings and doings) that the person can achieve. Capability is, thus, a set of vectors of functionings, reflecting the person's freedom to lead one type of life or another ... to choose from possible livings*" (ibid, p. 40).

Sen's focus on functionings and on the *capability* to achieve functionings differs from the traditional views of equality that tend to focus on variables such as income, wealth, or happiness (ibid, p. 7). Instead of measuring equality using such focal variables, Sen argues that a "*more adequate way of considering 'real' equality of opportunities must be through equality of capabilities (or through the elimination of*

unambiguous inequalities in capabilities, since capability comparisons are typically incomplete)" (ibid, p. 7).

Sen identified a fundamental problem with Rawls's formulation of the difference principle. "*Two persons holding the same bundle of primary goods can have very different freedoms to pursue their respective conceptions of the* [greater] *good (whether or not these conceptions coincide). To judge equality - or for that matter efficiency – in the space of primary goods amounts to giving priority to the means of freedom over any assessment of the extents of freedom, and this can be a drawback in many contexts*" (Sen 1992, pp. 8-9).

Thus, Sen argues that equality in the holdings of primary goods or resources ignores the fact that disadvantaged members of society may not have the capability or freedom to convert these goods/resources into the things that he/she values. Therefore, if a government were to use primary goods as a measure of well-being for purposes of justice, there is a concern that disadvantaged members of society might suffer from unjust (or unequal) treatment. To put it another way, these people are likely to have an unfair share of opportunity. Thus, Sen's capability-based assessment of equality forms the foundation for affirmative action, for empowering the powerless, and for positive discrimination (Bidwai 1998).

Sen's theories on capabilities and functionings and Rawls's theory of 'justice as fairness' have had a significant impact on how governments have shaped social arrangements to establish equitable and just societies. Sen's theories have also provided a strong conceptual foundation for the UN's work on human development (Fukuda-Parr 2002).

In particular, his ideas have shaped the UN Human Development Reports (HDRs) and the Human Development Index (HDI), including its extensions.The essence of Sen's conception of equality is that "*a person's capability to achieve does indeed stand for the opportunity to pursue his or her objectives*" (Sen 1992, p. 7). From this premise, the UN defined human development as the "*process of enlarging people's choices*" (UN 1995, p. 11) and sought the removal of obstacles - "*such as illiteracy, ill health, lack of access to resources, or lack of civil and political freedoms*"

(Fukuda-Parr 2002, p. 3) - that prevent an individual from achieving his/her valued objectives in life.

Thus, the intention of the UN HDI was to shift international attention to the expansion of basic human capabilities, especially the capability to
[1] have a healthy life,
[2] acquire knowledge, and
[3] reach a decent standard of living.

As the purpose of the HDR is the "*global evaluation of development*," these three indices were selected for their universal value since they form the basis from which many choices in life depend (Fukuda-Parr 2002, p. 6).

The disparity between nations identified by the HDRs and the HDI has its counterpart in the gaps between the rich and poor *within* nations. Evidence indicates that there is a growing divide between the income of high-paid and low-paid workers in the U.S. that is creating an 'apartheid economy' of haves and have nots (Barnet 1993; Freeman 1996a; Head 1996; Madrick 1999; Morris and Western 1999). An important work – *The New Geography of Global Income Inequality* (Firebaugh 2003) - which takes a holistic look at global income inequality, provides supporting evidence that since the last third of the twentieth century, income inequality within nations (including the U.S., China, India, and the former USSR) has been increasing. Interestingly, Firebaugh (2003) reaches the conclusion that with the spread of industrialization to developing nations there has been a corresponding decrease in inequality between nations during this period. This conclusion stands in stark contrast to the World Bank's *World Development Report 2000/2001* (p. 51), which claims that "*income inequality between nations has increased sharply over the past 40 years.*"
To a large extent, the manner in which income inequality is addressed in the U.S. will depend upon the degree to which the nation leans towards a 'human development' – and away from a 'neo-liberal' - view of development. The former view is more likely to distribute economic gains through taxes or a higher minimum wage, for example. The latter view is more likely to adopt the view that economic

growth will eventually improve everyone's well-being and is less concerned with economic inequalities in the near term.

Sen (1999, p. 14) recognizes the importance of economic growth, but argues that an "*adequate conception of development must go much beyond the accumulation of wealth and the growth of gross national product and other income-related variables.*" Thus, development needs to be concerned with "*enhancing the lives we lead and the freedoms we enjoy*" (ibid, p. 14).

Sen's contribution to our understanding of equality and his more recent notion of development as "*a momentous engagement with freedom's possibilities*" (Sen 1999, p. 298), provides one of the only credible challenges to the neo-liberal (or utilitarian) orthodoxy that has guided development efforts since the 1980s (Saha 2002). Sen's work has also had an important influence on the formulation of sustainable development, which he defines as "*development that promotes the capabilities of present people without compromising capabilities of future generations*" (Sen 2000, p. 5). Sen believes that the Brundtland (need-centered) view of development is "*illuminating,*" but "*incomplete*" (ibid, p. 2). He argues that individuals must be seen as "*agents who can think and act, not just as patients who have needs that require catering*" (ibid, p. 2). His basic premise is that by treating people as agents they will - given the opportunity – be able to "*think, assess, evaluate, resolve, inspire, agitate, and through these means, reshape the world*" (ibid, p. 1). Hence, Sen advocates a *capability-centered* approach to sustainable development. The objective of Sen's ideas is to "*integrate the idea of sustainability with the perspective of freedom, so that we see human beings not merely as creatures who have needs but primarily as people whose freedoms really matter*" (ibid, p. 6).

As mentioned earlier, one of Sen's major contributions to sustainable development is his influence on the UN's conceptualization of human development that formed the basis for the HDRs and HDI. Fukuda-Parr (2002), the Director of the HDRs since 1995, argues that it is possible to describe the UN's general human development agenda using five core elements (listed below). Fukuda-Parr calls these five elements the 'New York Consensus' since they are reflected in many of the UN agreements. It

is interesting to note the similarities between Sen's ideas on human development and those ideas presented in the New York Consensus.

The five elements of the UN's general human development agenda (or the New York Consensus) are as follows:

 "*Priority to 'social development' with the goals of expansion of education and health opportunities;*

 Economic growth that generates resources for human development in its many dimensions;

 Political and social reforms for democratic governance that secure human rights so that people can live in freedom and dignity, expanding ... [collective] *agency, participation and autonomy;*

 Equity in above three elements with a concern with all individuals. Special attention to the downtrodden and the poor whose interests are often neglected in public policy; [and]

 Policy and institutional reforms at the global level that create a more conducive economic environment for poor countries to have access to global markets, technology, information"
(Fukuda-Parr 2002, p. 10).

The above list presents a robust agenda (or paradigm) for *human* development, but human development is only a part - although an extremely vital part - of the broader notion of sustainable development. If we take a holistic look at all of the UN agreements, it is possible to identify several additional elements which, if added to the New York Consensus, would transform it to a consensus of sustainable development. As will be discussed in Section 3, it is possible to describe the notion of sustainable development - as viewed by the international community - using five critical components:

[1] peace and security;

[2] economic development;

[3] social development;

[4] national governance that ensures peace and development; and

[5] environmental protection (Dernbach 1998; 2004).

A comparison of these five components with the five elements listed above reveals that national governance that ensures peace and security, environmental protection, and employment (an important objective of economic and social development) are not explicitly mentioned in Fukuda-Parr's New York Consensus. Hence, if we are to integrate human development with the broader notion of sustainable development, the following elements need to be added:

☐ Environmental protection at the local, regional, national, and global level constitutes an integral part of the social and economic development process and is not to be considered in isolation from it.

☐ Equity considerations extend to future generations.

☐ National governance that ensures peace and security.

☐ The creation of secure, satisfying, and safe employment with adequate purchasing power.

The first three additional elements might be called the 'Rio elements' as they stem from the 1992 Rio Declaration on Environment and Development. A significant challenge posed by these new elements lies not so much with the need to protect the environment or with peace and security (although achieving these objectives has proved far from easy), but with the idea of intergenerational equity. Put simply, it is apparent that we are unable to allocate resources equitably in the present, let alone across generations. Hence, we do not have a *near future* that is properly allocated. Further, the ability of governments to develop equitable social arrangements that *also* transition societies towards more sustainable forms of development will depend upon how they, and society, view the purpose of development - i.e., either to establish a fair and just society (Rawlsianism) or alternatively to maximize the well-being of society in the neoclassical sense.

2.3 The Emergence of Sustainable Development

The concept of sustainable development obtained international recognition at the 1992 United Nations Conference on Environment and Development (UNCED) in

Rio de Janeiro, Brazil. However, it is possible to trace the "modern" environmental movement back to the early 1960s, when developed nations - the U.S. in particular – became increasingly aware that the *local* or *regional* environment was being stressed by rapid industrialization.

This chapter traces the rise of the concept of sustainable development during the twentieth century. It begins with a comprehensive look at the level of national activities designed to protect the environment from 1900 until the late twentieth century. The focus then shifts to the 1960s to identify the main factors which established the national environmental agenda in the U.S. This is followed by a review of the major forces which led the international community to begin to address the combined topic of development and the environment during the 1970s, which laid the foundation for the concept of sustainable development.

Over the past forty years, the *drivers* of sustainable development have incorporated – to varying degrees and at different times - what can now be recognized as four environmentally different concerns.

First is the disruption of ecosystems and loss of biological diversity and the indirect effects these have on human health and well-being. This concern was initially raised in the early 1960s when industrial processes and the use of pesticides led to environmental degradation and a loss of wildlife (Carson 1962), and then again more recently in the context of endocrine disruptors that affect reproductive health in all species (Colburn et al. 1996; Solomon and Schettler 1999). Significant progress has been made on improving industrial and agricultural practices; however, the negative impacts of these sectors still present a problem in both developed and developing countries.

The second concern relates to the world's finite resources and energy supplies, and asks the question of whether there are sufficient resources to fuel the economy in its current form (Georgescu-Roegen 1971; Meadows et al. 1972; Schmidt-Bleek 1992). A corollary concern is what will the environmental impact be from using a significant proportion of the existing resources?

The third concern is that toxic pollution directly affects human health and the health of other species (Ashford and Miller 1998; Chivian et al. 1993; Colburn et al. 1996; 1974; 1979; Commoner 2000; Fagin and Lavelle 1996; Geiser 2001; McCally 1999; Schettler et al. 1999). As scientists began to understand how ecosystems, humans, and other organisms were affected by industrial and agricultural processes, the issue of how toxic chemicals interact with biological tissue grew in importance.

The final concern is that greenhouse gases from anthropocentric (human-driven) sources are leading to a disruption of the global climate (Schmidheiny 1992). Scientists predict that these gases will cause the globally averaged surface air temperature to increase 1.4 to 5.6°C by 2100, relative to 1990, and the globally averaged sea level to rise 0.09 to 0.88m by 2100 (IPCC, 2001) with consequent dramatic changes in weather, droughts, and floods.

The first, third, and fourth environmental drivers of sustainable development are connected with the unintended effects of human development/growth while the second driver deals with increasing shortages of resources needed to fuel development/growth. It is noteworthy that the seeds for each of the four environmental drivers seem to have been planted during the 1960s and 1970s. As mentioned above, the 1960s was the era when the destruction of ecosystems was recognized as a significant problem in the U.S.

The other three environmental drivers of sustainable development began to emerge – to varying degrees - during the 1970s. The Stockholm Conference on the Human Environment in 1972 brought the topics of ecosystem integrity, biological diversity, and human health and the issue of ecological and resource limits to growth to the attention of the international community. While the conference did raise the potential problem with toxic substances (in its Action Plan), the third environmental driver of sustainable development remained the focus of national legislation during the 1970s. The passage of the 1976 Toxic Substances Control Act in the U.S. is a prime example. Towards the end of the 1970s, the international community began to discuss the related concerns of ozone depletion and greenhouse gas emissions - the fourth environmental driver of sustainable development. However, it was not until

the second half of the 1980s and the 1990s that international action was taken to address ozone depletion and global climate change, respectively.

In the 1980s, chemical toxicity began to be downplayed as the chemical industry itself started to point the finger at climate change as the most important environmental problem, almost to the exclusion of toxicity.167 The 1980s also marks a turning point when nations began to recognize that their environmental problems extended beyond national boundaries and were having impacts on a global scale. This realization spurred the formation of an international environmental agenda, and the actions taken in the following two decades as a result of this agenda can be considered to be the first attempt at global environmental governance (Speth 2003). Towards the end of the 1980s, the World Commission on Environment and Development (WCED) presented what became the first universally accepted definition of sustainable development.

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs. It contains within it two key concepts:
□ the concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and
□ the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future need .

Thus the goals of economic and social development must be defined in terms of sustainability in all countries - developed or developing, market-orientated or centrally planned. Interpretations will vary, but must share certain general features and must flow from a consensus on the basic concept of sustainable development and on a broad strategic framework for achieving it" (WCED 1987, p. 43).

This definition (commonly known as the Brundtland definition, after Gro Harlem Brundtland, the Commission's Chairman) highlights what has since become one of the major issues of contention with sustainable development. The *interpretation* of sustainable development by one nation might be seen as leading to 'unsustainable' development by another. The ongoing debate between (affluent) developed and

(poorer) developing nations is testimony to this fact. Having been forced by society to address the problems of industrialization, developed nations argue that their environmental and worker health and safety standards should guide the development process in developing countries. However, developing countries argue that this approach puts them at a disadvantage with regards to development, and it infringes upon their sovereignty. It also bypasses what they see as the bigger problem of over-consumption by the North. Another argument put forward by developed countries is that the creation of a global market will facilitate economic growth, raising the level of wealth within a nation and enabling it to invest (later) in solving the environmental problems associated with development. Developing nations counter this assertion by stating that there has been little evidence that such an approach to development works and that the environmental damage that does occur might well be irreversible. Table 3.1 presents a simplified summary of these types of positions. This chapter explores the above arguments and looks at how the international agenda for the environment and development was established and then transformed into the sustainable development agenda of today.

Table 3.1: Some Contributions and Dangers to Sustainable Development in Developed and Developing Nations

Global position	Contributions to Sustainable Development	Dangers to Sustainable Development
Developed Nations	Technological and managerial capacity; Frameworks for protecting the environment and worker health and safety	Over-consumption; Alienation; Meaninglessness
Developing Nations	Cultural heritage of needs centered living; Communityempowerment; Connection to nature	Population growth; Rising expectations

Source: Adapted from Cock (2002, p.186)

When the environment was first taken into consideration in government policy making, in the 1970s, the goal was to seek an optimum balance between protecting nature and reducing pollution and risks on the one hand, and the economic and social dimensions of development on the other. The emphasis has shifted away from purely quantitative growth to a conception of development that includes its social and cultural aspects. We have entered the age of eco-development, or sustainable development – a concept that includes the management and protection of our natural capital.

Since the first United Nations Conference on the Environment in Stockholm, in June 1972, which gave rise to the United Nations Environment Programme (UNEP), human history has accelerated. There are now nearly 200 conventions and international treaties on the environment and nature protection.

The second United Nations Conference on Environment and Development (the "Rio Summit" of 1992) was a major international event that gave rise to:

• the convention on climate change, which entered into force on 21 March 1994,

• the convention on biological diversity,

• Agenda 21,

•agreement on a convention on desertification (signed in 1994),

• renewal of the commitment made by the United Nations General Assembly in 1970 to

Agenda 21, a programme for the 21st century

The most outstanding outcome of the 1992 Rio Summit was the development of an action programme for sustainable development, known as Agenda 21. This sets out 38 programme objectives, along with the issues at stake.

The Earth Sciences are in a position to make relevant contributions to half of these, including:

• promoting traditional, ecologically sustainable production methods and better energy and resource use;

• conservation and management of resources for development purposes; observation and information systems; resource inventories; knowledge bases on soils, water and ecosystems; surveys of the most vulnerable risk-prone areas; integrated coastal zone management; protection of freshwater resources and their quality; risk-reduction programmes; ecologically sound waste management; and so on.

• transfers of ecologically sound techniques, cooperation, training in skills, etc.

increase (but with no specified deadline) development assistance to 0.7% of GDP in the industrialised countries.

If development is to be sustainable, specific management rules have to be enforced, for several reasons:
• our natural capital is an irreplaceable factor of economic growth;
• natural resources are factors of human welfare in themselves (beauty of a site, recreation, health, etc.);
• some resources are not renewable and can even disappear altogether (animal and plant species, natural sites, minerals, fossil energy sources).

These raise the question of the irreversible effects of certain human activities; New global models: worldwide research on climate change and sustainable development has produced global models that link "natural" phenomena (climate, resource conditions), human activity (emissions and extractive activities), economics (modes of development) and methods of government control (legislation, regulations).
• many resources cannot be replaced artificially (tropical forests, marshes, oceans, declining species and so on);
• the timeframe is crucial, since we have to be able to pass on a viable heritage to the next generations.

Table 3.4: Dernbach's Model of 'Sustainable Development' and the Rio Principles

Component of *Sustainable* Development	Rio Principles
Peace and Security	**Principle 24** - Warfare is inherently destructive of sustainable development. States shall therefore respect international law providing protection for the environment in times of armed conflict and cooperate

	in its further development, as necessary.
	Principle 25 - Peace, development and environmental protection are interdependent and indivisible.
	Principle 26 - States shall resolve all their environmental disputes peacefully and by appropriate means in accordance with
	the Charter of the United Nations.
Economic Development	**Principle 5** - All States and all people shall cooperate in the essential task of eradicating poverty as an indispensable requirement for sustainable development, in order to decrease the disparities in standards of living and better meet the needs of the majority of the people of the world.
	Principle 12 - States should cooperate to promote a supportive and open international economic system that would lead to economic growth and sustainable development in all countries, to better address the problems of environmental degradation. Trade policy measures for environmental purposes should not constitute a means of arbitrary or unjustifiable discrimination or a disguised restriction on international trade. …
	Principle 25 - above.

Social Development	**Principle 1** - Human beings are at the centre of concerns for sustainable development. They are entitled to a healthy and productive life in harmony with nature. **Principle 8** - To achieve sustainable development and a higher quality of life for all people, States should reduce and eliminate unsustainable patterns of production and consumption and promote appropriate demographic policies. **Principle 20** - Women have a vital role in environmental management and development. Their full participation is therefore essential to achieve sustainable development. **Principle 21** - The creativity, ideals and courage of the youth of the world should be mobilized to forge a global partnership in order to achieve sustainable development and ensure a better future for all. **Principle 25** - above.
National Governance that Secures Peace and Development (or more generally, National Governance that Secures Sustainable Development)	**Principle 3** - The right to development must be fulfilled so as to equitably meet developmental and environmental needs of present and future generations. **Principle 10** - Environmental issues are best handled with participation of all concerned citizens, at the relevant level. At

	the national level, each individual shall have appropriate access to information concerning the environment that is held by
	public authorities, including information on hazardous materials and activities in their communities, and the opportunity to participate in decision-making processes. States shall facilitate and encourage public awareness and participation by
	making information widely available. Effective access to judicial and administrative proceedings, including redress and
	remedy, shall be provided.
	Principle 11 - States shall enact effective environmental legislation. Environmental standards, management objectives and
	priorities should reflect the environmental and development context to which they apply. Standards applied by some
	countries may be inappropriate and of unwarranted economic and social cost to other countries, in particular developing countries.
	Principle 13 - States shall develop national law regarding liability and compensation for the victims of pollution and other
	environmental damage. States shall also cooperate in an expeditious and more determined manner to develop further

	international law regarding liability and compensation for adverse effects of environmental damage caused by activities within their jurisdiction or control to areas beyond their jurisdiction.
	Principle 22 - Indigenous people and their communities and other local communities have a vital role in environmental management and development because of their knowledge and traditional practices. States should recognize and duly support their identity, culture and interests and enable their effective participation in the achievement of sustainable development.
'Strong' Environmental Protection Measures (Note: These Rio Principles explicitly link the development process with the environment, which is why they have been called 'strong' environmental protection measures.)	**Principle 4** - In order to achieve sustainable development, environmental protection shall constitute an integral part of the development process and cannot be considered in isolation from it. **Principle 7** - States shall cooperate in a spirit of global partnership to conserve, protect and restore the health and integrity of the Earth's ecosystem. In view of the different contributions to global environmental degradation, States have common

	but differentiated responsibilities. The developed countries acknowledge the responsibility that they bear in the
	international pursuit to sustainable development in view of the pressures their societies place on the global environment
	and of the technologies and financial resources they command.
	Principles 8, 11, and 13 - above.
	Principle 14 - States should effectively cooperate to discourage or prevent the relocation and transfer to other States of any
	activities and substances that cause severe environmental degradation or are found to be harmful to human health.
	Principle 15 - In order to protect the environment, the **precautionary approach** shall be widely applied by States
	according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty
	shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation.
	Principle 16 - National authorities should endeavour to promote the **internalization of environmental costs** and the use
	of economic instruments, taking into account the approach that the polluter

	should, in principle, bear the cost of pollution, with due regard to the public interest and without distorting international trade and investment.
	Principle 17 - **Environmental impact assessment**, as a national instrument, shall be undertaken for proposed activities that are likely to have a significant adverse impact on the environment and are subject to a decision of a competent national authority.
	Principle 18 - States shall immediately notify other States of any natural disasters or other emergencies that are likely to produce sudden harmful effects on the environment of those States. Every effort shall be made by the international community to help States so afflicted.
	Principle 19 - States shall provide prior and timely notification and relevant information to potentially affected States on activities that may have a significant adverse transboundary environmental effect and shall consult with those States at an early stage and in good faith.
	Principle 23 - The environment and natural resources of people under

	oppression, domination and occupation shall be protected. **Principles 25 and 26** - above.

The catalyst behind much of the research into indicators for sustainable development can be traced back to the OECD and the 1992 UN Conference on Environment and Development.

In 1989, the OECD Council called for the integration of environmental and economic decision-making that was reaffirmed by the G-7 summits in Paris (1989) and Houston (1990) (OECD 1997; 2003). Two years later, the 'Council Recommendation on Environmental Indicators and Information' was approved by OECD governments and asked for the development of "*core sets of reliable, readable, measurable and policy relevant environmental indicators*" (OECD 2003, p. 20). In 1993, the OECD released its *Core Set of Indicators for Environmental Reviews* (OECD 1993) along with the Pressure- State-Response (PSR) framework, which has since formed the conceptual foundation of many indicator initiatives. It is important to stress that this *international* initiative focused on the *environmental* aspects of sustainable development to the exclusion of social and economic factors. However, this omission was later addressed during an OECD Council meeting in 2001, where ministers called for the development of "*indicators to measure progress across all three dimensions of sustainable development*" (OECD 2003, p. 20). Building upon earlier stress-response frameworks that consider both *natural* (e.g., storms, earthquakes, volcanic activity, etc.) and *human* activity (Rapport and Friend 1979), the OECD developed the PSR framework. The purpose of the PSR framework was to highlight *cause-effect* relationships to enable decision-makers and the public to understand how their actions could affect the state of the environment and help them craft responses to reduce environmental harm (Figure 5.2).

Environmental 'pressure' is defined in terms of human activity and is measured using indicators that reflect *flows/rates* such as production, consumption, and trade. Indicators of environmental pressure typically track emissions or resource usage.

However, indicators that measure other types of human pressure, such as changing land use patterns, are also considered.

The 'state' (or position) of the environment reflects how environmental pressures are changing the quality of the environment and the quantity (or availability) of natural resources. The indicators are designed to measure environmental *stocks* - i.e., the amount of pollution in the atmosphere, the area of contaminated land, etc.

The 'response' element of the PSR framework measures the actions taken by society (individually and collectively) to remediate existing environmental damage (to improve the 'state') or change human activities (i.e., reduce the 'pressures') that are seen to degrade the state of the environment. The types of indicators that are used to measure societal response vary significantly, but they generally relate to abatement and control measures. Examples include pollution abatement rates, fishing quotas, protected areas as a percentage of national territory, percentage of the vehicle fleet fitted with catalytic converters, environment-related taxes and subsidies, pricing structures, and waste recycling rates.
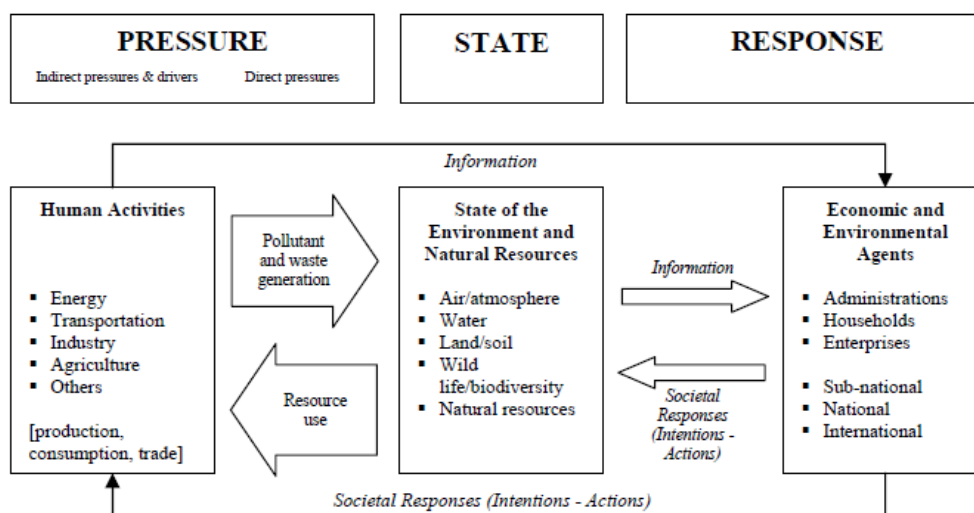
Figure 5.2: The OECD Press-State-Response (PSR) Model

A general critique of indicator frameworks based upon the PSR model is that they only consider human pressures on the environment and ignore the impacts of natural processes (Berger and Hodge 1998). In addition, Spangenberg and Bonniot (1998, p. 6) argue that the PSR model "*reflects a kind of political 'end-of-the-pipe-thinking'*

and thus cannot meet the requirements of proactive environmental policies." This means that the PSR model tends to focus our attention on what can be measured - i.e., the state of the environment. Therefore, political (short-term) attention is directed away from addressing the complex (long-term) problem of understanding which pressures might be affecting the state of the environment. In addition, unless social and ecological factors are integrated in the analysis of pressures, the final solutions are likely to be inadequate.

Running in parallel with the OECD's efforts to develop environmental indicators was the UN initiative to develop indicators of sustainable development. In response to *Agenda 21*, the UN Commission for Sustainable Development (UNCSD) formed a 'Work Programme on Indicators of Sustainable Development' (1995-2000).585 During the early phase of the program, the UN focused on extending the OECD PSR framework of environmental indicators to include social, economic, and institutional dimensions. In addition, it linked indicators to the relevant chapters in *Agenda 21*. At the fourth session of the UNCSD in 1996, a preliminary list of 134 indicators (each accompanied by a methodology sheet) was released (UNDSD 1996). The indicators were structured according to the UN's Driving Force-State-Response (DSR) framework. The UN DSR framework used the term 'driving force' instead of 'pressure' to represent *human activities, processes, and patterns that impact on sustainable development either positively or negatively*" (UNDSD 2001b, p. 19). The term 'state' referred to the broader condition of sustainable development and 'response' to the government and social actions aimed at transitioning human activities away from unsustainable development.

During a three-year trial period (1996-1999), 22 countries attempted to apply and develop the UN's set of indicators to their home nation (UNDSD 1999). The main conclusion from these trial runs was that the UN DSR framework works for environmental indicators, but is not suitable for the social, economic, and institutional dimensions of sustainable development. The complexity associated with trying to establish causal links between pressures affecting the state of the economy or social conditions meant that it was not possible to develop a robust causal model. Further, gaps in the indicator set were identified and the sheer number of indicators was too great. Based upon this information it would seem unwise for the OECD to attempt to extend its PSR model beyond environmental considerations to include economic and social dimensions of sustainable development, as per the 2001

Ministers directive. This raises the question of what type of framework should be used.

In response to the inherent problems with the DSR model, the UN Expert Group on Indicators of Sustainable Development recommended that the indicator set be refocused towards policy-oriented themes of sustainable development. The rationale for this change was that the indicators would be more useful if they aligned with national decision-making and performance measurements (UNDSD 2001b). Following a series of consultations and workshops, the UNCSD adopted a *theme/sub-theme framework* that consisted of 15 themes and 38 sub-themes (Table 5.4). In this new framework, the original 134 indicators are reduced to 58. While the UN DSR framework has effectively been discontinued, Table 5.4 shows how each of the indicators in the UNCSD theme/subtheme framework could be labeled using the DSR framework. In addition, the numbers in brackets relate to the relevant chapter(s) of *Agenda 21*

Table 5.4: UNCSD Theme/Sub-Theme Framework Indicators of Sustainable Development

SOCIAL		
Theme	**Sub-theme**	**Indicator**
Equity	Poverty (3)	Percent of Population Living below Poverty Line
		Gini Index of Income Inequality
		Unemployment Rate
	Gender Equality (24)	Ratio of Average Female Wage to Male Wage
Health (6)	Nutritional Status	Nutritional Status of Children
	Mortality	Mortality Rate Under 5 Years Old
		Life Expectancy at Birth
	Sanitation	Percent of Population with Adequate Sewage Disposal Facilities
	Drinking Water	Population with Access to Safe Drinking Water
	Healthcare Delivery	Percent of Population with Access to Primary Health Care Facilities
		Immunization Against Infectious Childhood Diseases
		Contraceptive Prevalence Rate
Education (36)	Education Level	Children Reaching Grade 5 of Primary Education
		Adult Secondary Education Achievement Level
	Literacy	Adult Literacy Rate
Housing (7)	Living Conditions	Floor Area per Person
Security	Crime (36, 24)	Number of Recorded Crimes per 100,000 Population
Population (5)	Population Change	Population Growth Rate
		Population of Urban Formal and Informal Settlements
ENVIRONMENTAL		
Theme	**Sub-theme**	**Indicator**
Atmosphere (9)	Climate Change	Emissions of Greenhouse Gases
	Ozone Layer Depletion	Consumption of Ozone Depleting Substances
	Air Quality	Ambient Concentration of Air Pollutants in Urban Areas
Land (10)	Agriculture (14)	Arable and Permanent Crop Land Area
		Use of Fertilizers
		Use of Agricultural Pesticides
	Forests (11)	Forest Area as a Percent of Land Area
		Wood Harvesting Intensity
	Desertification (12)	Land Affected by Desertification
	Urbanization (7)	Area of Urban Formal and Informal Settlements
Oceans, Seas and Coasts (17)	Coastal Zone	Algae Concentration in Coastal Waters
		Percent of Total Population Living in Coastal Areas
	Fisheries	Annual Catch by Major Species
Fresh Water (18)	Water Quantity	Annual Withdrawal of Ground and Surface Water as a Percent of Total Available Water
	Water Quality	BOD in Water Bodies
		Concentration of Faecal Coliform in Freshwater
Biodiversity (15)	Ecosystem	Area of Selected Key Ecosystems
		Protected Area as a % of Total Area
	Species	Abundance of Selected Key Species

ECONOMIC		
Theme	**Sub-theme**	**Indicator**
Economic Structure (2)	Economic Performance	GDP per Capita
		Investment Share in GDP
	Trade	Balance of Trade in Goods and Services
	Financial Status (33)	Debt to GNP Ratio
		Total ODA Given or Received as a Percent of GNP
Consumption and Production Patterns (4)	Material Consumption	Intensity of Material Use
	Energy Use	Annual Energy Consumption per Capita
		Share of Consumption of Renewable Energy Resources
		Intensity of Energy Use
	Waste Generation and Management (19-22)	Generation of Industrial and Municipal Solid Waste
		Generation of Hazardous Waste
		Generation of Radioactive Waste
		Waste Recycling and Reuse
	Transportation	Distance Traveled per Capita by Mode of Transport
INSTITUTIONAL		
Theme	**Sub-theme**	**Indicator**
Institutional Framework (38, 39)	Strategic Implementation of SD (8)	National Sustainable Development Strategy
	International Cooperation	Implementation of Ratified Global Agreements
Institutional Capacity (37)	Information Access (40)	Number of Internet Subscribers per 1000 Inhabitants
	Communication Infrastructure (40)	Main Telephone Lines per 1000 Inhabitants
	Science and Technology (35)	Expenditure on Research and Development as a Percent of GDP
	Disaster Preparedness and Response	Economic and Human Loss Due to Natural Disasters

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The development of the theme/sub-theme framework was driven by four main considerations: future risks; correlation between themes; sustainability goals; and basic societal needs (PriceWaterhouseCoopers 1999). However, its development was somewhat constrained by the need to limit the number of indicators and the problem of identifying validated and widely accepted national indicators (UNDSD 2001a). For these reasons the framework could not include all aspects of sustainable development, leading to the exclusion of issues such as resource extraction (mining), tourism, groundwater quality, and biotechnology (UNDSD 2000). Thus, the intent of the theme/sub-theme framework is to reflect the core themes of sustainable development while remaining practical from a policy perspective. The hope is that nations will develop their own versions of the framework, commensurate with their priorities, conditions, and ability to maintain a national indicator system. If all nations use the UN framework as a basis, there is likely to be some uniformity between national indicator systems that will help facilitate international comparisons.

3.1 Transportation and Sustainable Development

The purpose of this chapter is to [1] introduce important transportation terminology and system representations, [2] review the concept of sustainable transportation, [3] present a decision-support framework that encourages the creation of transportation policies/programs that support sustainable development, and [4] present a set of national-level sustainable transportation indicators developed using the UNCSD indicator framework.

3.1.1 The Transportation System: Terminology and System Representations

This section introduces terminology that is often used to describe a transportation system and presents several ways in which a transportation system can be represented or visualized. Particular attention is given to the notion of a *system boundary* that is often used to limit the scope of a systems analysis.

It is helpful to begin by considering what is meant by a *system*. Three useful definitions of a *system*, a *complex system*, and an *engineering system* developed by Magee and de Weck (2002, p. 4) are as follows:

— "*System: a set of interacting components having well-defined (although possibly poorly understood) behavior or purpose; the concept is subjective in that what is a system to one person may not appear to be a system to another.*"

— "*Complex System: a system with numerous components and interconnections, interactions or interdependencies that are difficult to describe, understand, predict, manage, design, and/or change.*"

— "*Engineering System: a system designed by humans having some purpose; large scale and complex engineering systems ... will have a management or social dimension as well as a technical one.*"

Magee and de Weck's (2002) description of an *engineering system* can be linked to the idea of a *socio-technical system*, first conceived in Norway in the mid 1950s (Emery and Trist 1960). In its simplest form, the concept of a socio-technical system refers to the *joint operation* of social and technological systems to achieve a desired goal (Davis and Taylor 1972). Thus, when humans are required actors in a process (or system), the desired outcome is achieved through the actions of a social system as well as a technical system. The main difference between the definitions is the specific reference to *large scale* and *complex* systems in the definition of an engineering system. The transportation system is a good example of an engineering system.

3.1.2 Sustainable Transportation

"*There can be no sustainable development without sustainable transportation. It is an essential component not only because transportation is a prerequisite to development in general but also because transportation, especially our use of motorized vehicles, contributes substantially to a wide range of environmental problems, including energy waste, global warming, degradation of air and water, noise, ecosystem loss and fragmentation, and desecration of the landscape. Our* 605 A *transportation enterprise* is defined as "*all people, organizations and infrastructure involved with transportation investment, labor, management, operations and uses. It includes private companies, public agencies, citizen groups and individuals*" (U.S. DOT 2000, p. i). *nation's environmental quality will be sustainable only if we pursue transportation in a sustainable way*" (Benfield and Replogle 2002, p. 647).

The transportation system is often envisioned as the engine of development. It is seen as the backbone of the twentieth century's economic and social progress and is the means by which humans access goods and services and connect to communities. Yet, the transportation system is also a major contributor to environmental degradation and community disruption. One might also argue that the falling costs and increasing efficiency of the transportation system has enabled the emergence of the 'throughput society'. The ease with which materials and goods can be moved across and between

nations has transformed the structure of national economies, which are becoming increasingly interconnected. This process is further enhanced by the emergence of information and communication technology (ICT) throughout the world. The complexity unleashed by the integration of regional and national economies means that tracing *who* is responsible for negative externalities - i.e., resource extraction firms, manufacturers, consumers, government, etc. - is not a simple question to ask or answer. One is immediately faced with concerns of national and consumer sovereignty and hard questions about what is the *right* or *just* solution to a problem.

A closer look at the environmental divers of the concern for sustainable development reveals that the transportation system has played – and continues to play - a significant role in fueling these indicators of unsustainable development.

First, the transportation system is responsible for a wide range of impacts that affect *ecosystem integrity and biological diversity and indirectly affect human health and wellbeing* - the first environmental driver of the concern for sustainable development.

Second, the transportation system relies upon *non-renewable resources and energy supplies* to build/maintain infrastructure, manufacture transportation vehicles/equipment, and power the system - the second environmental driver of the concern for sustainable development.

Third, *toxic chemicals* released during the manufacture and disposal of transportation vehicles/equipment and through the incomplete combustion of fossil fuels can *directly affect human health and the health of other species* - the third environmental driver of the concern for sustainable development.

Finally, *ozone depleting substances and greenhouse gases* released from motor vehicles and transportation equipment play a major role in the *disruption of the global climate* - the fourth environmental driver of the concern for sustainable development.

At the time of the Rio Conference, national governments and international agencies

began to develop their own positions on sustainable transportation. A notable example is the Commission of the European Communities' Green Paper on 'The Impact of Transport on the Environment' (EC 1992).

The Green Paper defined a 'sustainable mobility framework' as one that:

— contains "*the impact of transport on the environment*[;]"

— allows "*transport to continue to fulfil its economic and social functions*[;]"

— contributes "*to social and economic cohesion ... and to the creation of new opportunities for the peripheral regions*[;]"

— safeguards "*the freedom of choice for the user*[;]" and

— identifies, "*in accordance with the principle of subsidiarity, the responsibility which the different actors will have to assume in order to achieve the objective of the strategy*" (EC 1992, p. 55).

Environment

A Sustainable Transportation System ...

Health & Environmental Damage	▪ minimizes activities that cause serious public health concerns and damage to the environment; [a, b, d]
Standards	▪ maintains high environmental quality and human health standards throughout urban and rural areas; [a]
Noise	▪ minimizes the production of noise; [b, c, d, e]
Land Use	▪ minimizes the use of land; [c, e]
Emissions and Waste	▪ limits emissions and waste to levels within the planet's ability to absorb them, and does not aggravate adverse global phenomena including climate change, stratospheric ozone depletion, and the spread of persistent organic pollutants; [b, c, d, e]
Renewable Resources	▪ ensures that renewable resources are managed and used in ways that do not diminish the capacity of ecological systems to continue providing these resources; [a, b, c, d, e]
Non-renewable Resources	▪ ensures that non-renewable resources are used at or below the rate of development of renewable substitutes; [a, b, c, d, e]
Energy	▪ is powered by renewable energy sources; and
Recycling	▪ reuses and recycles its components. [c]

Equity/Society

A Sustainable Transportation System ...

Access	▪ provides access to goods, resources, and services while reducing the need to travel; [a, c, e]
Safety	▪ operates safely; [a, c, e]
	▪ ensures the secure movement of people and goods;
Intragenerational Equity	▪ promotes equity between societies and groups within the current generation, [c, e] specifically in relation to concerns for environmental justice; and
Intergenerational Equity	▪ promotes equity between generations. [c, e]

Economy

A Sustainable Transportation System ...

|	
Affordability	▪ is affordable; [a, c, e]
Efficiency	▪ operates efficiently to support a competitive economy; [a, c, e] and
Social Cost	▪ ensures that users pay the full social and environmental costs for their transportation decisions. [a]

Key: [a] U.K. Round Table on Sustainable Development (1996) *Defining a Sustainable Transport Sector*, London; [b] OECD (1997) *Towards Sustainable Transportation* (the Vancouver Conference), Paris; [c] The Centre for Sustainable Transportation (1997) *Definition and Vision of Sustainable Transportation*, Ontario; [d] OECD (2000) *Environmentally Sustainable Transport (EST)*, Paris; [e] European Council (2001a) Council Resolution on *Integrating Environment and Sustainable Development Into Transport Policy*, Luxembourg.

Figure 3.1: A Comprehensive Definition of Sustainable Transportation

A visual representation of the Three E's of sustainable transportation is shown in Figure 3.1. This approach to visualizing the concept is useful from a policy perspective since it can help policy-makers develop a more structured and integrated

response to transportation-related externalities. However, a potential problem with this type of representation is that it implies that equity considerations can be traded-off against environmental and economic concerns. Making equity one of the three dimensions of sustainable transportation runs counter to the conceptualization of sustainable development formulated in next section.
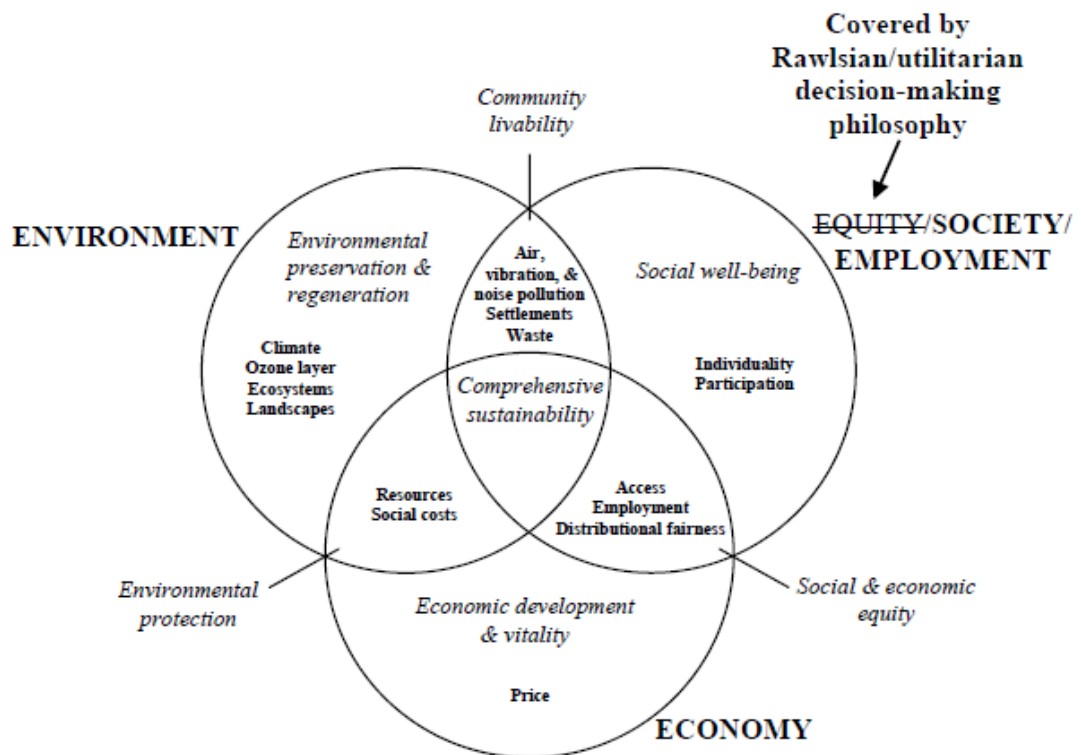
Sources: Adapted from CST (1997, p. 2) and Brodmann and Spillmann (2000, p. 8).

Figure 3.2: Visualization of the Three E's of Sustainable Transportation

At the heart of the Rawlsian/utilitarian decision-making philosophy (developed in Section 2.2.2) is the principle that every new social arrangement (e.g., a transportation policy) should reduce inequality by making the most disadvantaged members of society relatively better off. Therefore, adopting a framework where equity could be sacrificed for economic or environmental benefit runs against this principle. A better approach would be to replace the equity dimension with a more specific concern for social wellbeing and employment. Both of these factors are essential components of sustainable development and deserve explicit recognition. Considerations of equity and justice can then occur *within* each of the three dimensions of sustainable transportation.

Table 3.2: Negative Externalities Associated with Transportation

Environmental	Social	Economic
-Air pollution -Consumption of land/urban sprawl -Depletion of the ozone layer -Disruption of ecosystems and -Habitats Global climate change -Hydrologic impacts -Introduction of exotic species -Light pollution -Noise pollution -Release of toxic/hazardous substances -Solid wastes -Vibration pollution -Visual intrusion and aesthetics -Water pollution	-Accidents Declining community livability/ community partitioning -Human (psychological and physiological) health impacts -Inequalities associated with negative environmental and health impacts -Mobility barriers/inequalities for the disadvantaged -Time wastage -Visual pollution	-Costs of transportation to customers/consumers -Costs relating to accidents -Depletion of non-renewable resources and energy supplies (*also an environmental and intergenerational equity concern*) -Traffic congestion -Transportation facility costs -Transportation-related-health costs

Sources: Black (2005), Button (1993), Maddison et at. (1996), Rothengatter (2003), Spellerberg (2002), TRB (1997), Wachs (2005), Whitelegg (1993; 1997), Whitelegg and Haq (2003), VTPI (2005), and Zietsman and Rilett (2002).

Table 3.3: Principles of Sustainable Transportation

Environment	Equity/Society	Economy	Governance
Adopt - A precautionary and preventative approach to decision-making **Avoid** - Irreversible impacts -Global climate change - Pollution **Encourage** - Remanufacturing/reuse and recycling of transportation vehicles and equipment **Ensure** - The proper disposal of transportation related toxic materials and waste **Protect** - Habitats/ecosystems and operate within their assimilative and regenerative capacities - Biodiversity - Environmental aesthetics	**Enhance** - Safety - Human health - Social wellbeing/ quality of life **Promote** - Equity/distributional fairness - Access and choice -Environmental justice - Individual and Community responsibility -Meaningful employment in the transportation sector	**Ensure** - Transportation services are affordable - Transportation is cost effective - Natural and financial resources are used efficiently - Negative social and environmental costs are internalized - i.e., the polluter pays principle **Support** - Trade and business activity that enhances productiveness and contributes to development	**Encourage** - Technological innovation **Ensure** -Transparency and accountability - Public and stakeholder participation **Establish** - Goals and performance objectives **Support** - Comprehensive and long-term planning - Interagency and international cooperation - The integration and cooptimization of policy

Sources: OECD (1997), Hall (2002), Litman and Burwell (2003), and VTPI (2005).

Table 6.8: Moving Towards a Sustainable Transportation Decision-Support Framework - Current vs. Sustainability Approaches to Developing the Transportation System

	Current Approach	Sustainability Approach
System Conceptualization	*Mechanistic, linear, and reductionist -* Reduce the transportation system into a number of sub-systems - e.g., highways, bus networks, transit networks, cycleways, airports, etc. - where each sub-system is analysed separately/in isolation and the whole is considered to be the sum of the separate parts.	*Holistic systems approach –* The transportation system is considered as a series of interconnected socio technical systems that function like biological and ecological systems. A healthy system displays modal diversity for people and freight that increases with population size. The system is analysed both in terms of its sub-systems and their interconnections, as well as how the system/sub-systems interact with the natural environment. The whole cannot be analyzed as a simple sum of its parts.
Transportation Planning	Maximize system capacity, travel speed, and mobility. Land use considerations are often secondary to transportation planning	Maximize system efficiency through the provision of a highly interconnected and multimodal transportation system that encourages the use of the most efficient modes of transportation.

		and vice versa.	Promote accessibility rather than mobility. Land use planning (including environmental considerations) is an integral part of transportation planning; '*transportation-land-environment planning*' replaces '*transportation planning*' as a descriptor.
Stakeholder Involvement b		Modest level of stakeholder involvement. Stakeholders may provide information or are included at certain points of the planning process. Stakeholders are sometimes included In scenario planning/visioning exercises.	High level of stakeholder involvement. Stakeholders have a more influential role in the planning/decision-making process and are more cognizant of the distributional impacts of transportation policies/programs/projects. Stakeholders play a central role in participatory backcasting/scenario planning exercises.
Modal Choice		The automobile is the predominant and only choice of transportation for many people. In large metropolitan areas, public transportation is more accessible, but to varying degrees.	A more balanced approach to the provision of transportation is applied. Where feasible, innovative solutions should be tested to begin to bridge the gap between public and private transportation.

Funding	Transportation funding tends to be directed at specific modes. A significant proportion of available funding is targeted at highways since vehicles are the dominant mode of transportation.	Transportation funding is directed towards enhancing and integrating modal diversity and, in general, is not constrained to a particular mode. In a situation where the transportation system is largely built, funding focuses on operating, maintaining, and transforming the existing system towards a more sustainable form. Provide significant and sustained financial support for sustainable transportation research.
Strategic Objectives	— Safety; — Mobility; —Global connectivity/ economic growth; —Environmental stewardship; and — Security Strategic objectives are focused on *managing* areas where improvements are deemed necessary.	— Safety; — Accessibility; — Multimodality; — Economic development; — Environmental protection/enhancement; and — Security. Rather than simply *managing* the strategic areas,should search for ways to achieve *transformational improvements* in each

		area (see Competitiveness/Innovation).
Equity	Equity considerations are primarily informed by Title VI of the 1964 Human Rights Act, the 1990 Americans with Disabilities Act, and the 1994 Presidential Executive Order on Environmental Justice.	The principles of ethical transportation policy are applied in the choice of options and pathways for achieving those options. Federal law and guidance related to equity is adhered to.
Employment d	Ensure a supply of adequately trained people, facilitate dialogue with workers, and provide safe working environments.	Continue current approach while searching for radical improvements in the human-technology interface (i.e., the integration of human resources and engineering artifacts).
Economics and Policy Development/Analysis	Neo-classical economics. Policy development is based upon static efficiency. Primary analysis tools: Benefit-cost analysis (BCA) and cost-effectiveness analysis (CEA).	Ecological economics. Policy development is based upon *dynamic efficiency* - i.e., the need to consider how change occurs over time. Primary analysis tool: Tradeoff/ positional analysis (supported by the Rawlsian/utilitarian decisionmaking philosophy).
Competitiveness/ Innovation	Competitiveness is achieved by improving system efficiency and lowering the costs of transportation services.	Competitiveness is achieved through changing the nature of meeting market needs by encouraging radical or disrupting innovation.

	Innovation is encouraged through single-purpose government policies such as research programs, demonstration projects, government purchasing, market incentives, etc.	Innovation occurs through an integrated process of technological, institutional, social/behavioral, and organizational changes. Government policy is integrated and co-optimized (i.e., is designed to achieve multiple objectives) and a range of incentives (including more stringent environmental regulation - i.e., the 'strong' Porter hypothesis) is used to encourage disrupting innovation.
Externalities	A wide range of environmental, social, And economic externalities are identified or acknowledged, but a very limited effort is made to internalize the social costs of any negative transportation externalities.	A comprehensive set of environmental, social, and economic externalities is identified and significant effort is made to prevent or internalize the social costs of any negative transportation externalities either through mandated standards or economic instruments. Great care is taken to properly balance efficiency and equity.
Pollution and Waste	Control emissions and waste.	Pollution and waste are *prevented* through system changes wherever possible. Pollution and waste streams

		are kept within ecological limits.
Energy and Resources	Promote energy and resource conservation.	Transition resource and energy dependence away from non-renewable resources towards renewable resources. Promote dematerialization/ecological modernization.

4.1 Introduction - Transport and Climate Change in Delhi

4.1.1 The Development of Urban Form

With a population of 17 million, rising at a compound rate of 4 per cent a year, Delhi provides a very good vantage point from which to view the threat, not only because its transport system is not presently integrated but also because it is the capital city of a country that is home to more than one sixth of the world's citizens (*Economic Survey 2009–10*).

Since 70 per cent of the urban environment in Asian cities that will exist by 2050 has not yet been built, there are opportunities to develop sustainably and get ready for the transformation needed to cope with climate change challenges associated with rapid economic development (Penalosa 2008). Any successful attempt to create a multimodal transport system in India's capital city is likely to influence policy and practice in other parts of India with potentially enormous implications for developing a low carbon pathway in transport and the built environment.

Delhi also typifies an urban structure being replicated in other Asian cities that have been booming economically for the past 20 years since economic liberalization. Unlike older cities in Europe and the US that built a central business district (CBD) in an age before mass motorization based around extensive rail networks, Delhi has no clearly identifiable CBD. These are sprawling outwards, characterized by mixed use, quite low population density and generate comparatively modest trip lengths, the majority being less than 10 km. In this context the city is becoming heavily reliant upon more flexible, low-cost transport, principally cars and motorcycles.

4.2 Data collection

4.2.1 Road Infrastructure Development: Implications for Multimodality

As the city sprawls so does demand for mobility increase. Trip demand is expected to rise from approximately 20 million per day now to 29 million by 2021 (RITES 2005). To cater to this demand, Delhi already owns a higher number of vehicles than the next three Indian metropolises combined—presently more than 6 million with approximately 1,100 more being added each day. In addition to the emerging urban layout described above part of the explanation rests upon GDP, rising on average between 10 and 12 per cent per year. Average incomes are now over $2,000 per annum, the level at which most countries start buying into greater personal mobility, motorcycles, and cars (Dargay and Gately 2007).

Yet there remains significant room for market growth. According to the RITES study, approximately half of all Delhi households still do not own a car or motorcycle
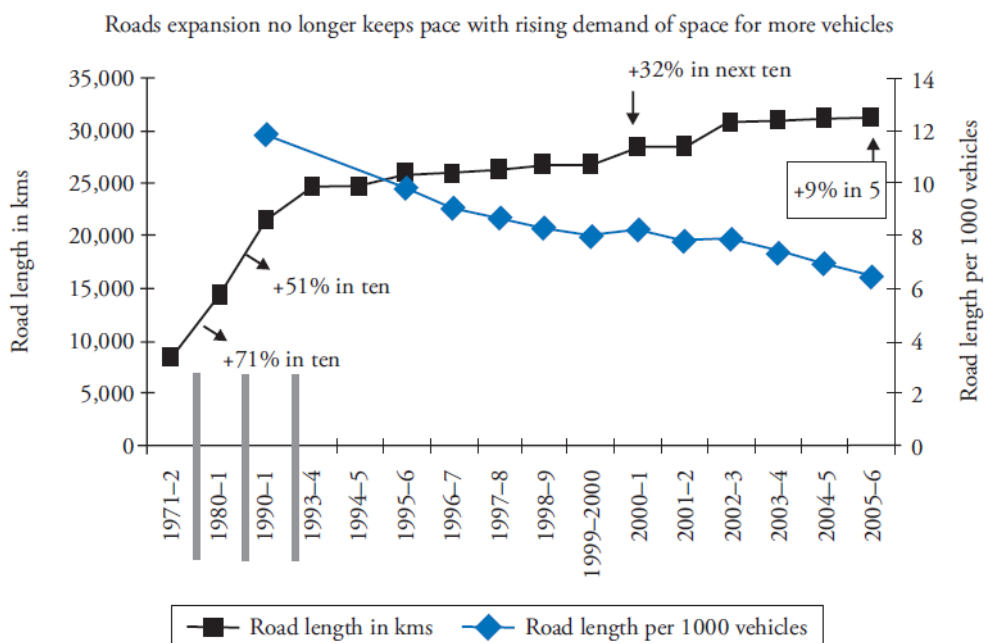
Figure 4.1 Expansion Struggling with Rising Space Demand

*Source*: Environment Pollution (Control and Prevention) Authority (2009).

(*Economic Survey 2009–10*; RITES Ltd and TERI 2010).

Ironically, on the ground is little room to accommodate future growth. Delhi already has one of the most capacious road networks in the world with 21 per cent (28,000 km) of the city's total area under tarmac and little room for further expansion. In the 25 years from 1971–2 Delhi's road network grew 3.7 times while the number of vehicles grew by more than 25 times. Offering less than 6 km per 1,000 vehicles, the road network in Delhi is rapidly becoming inadequate to the task of catering for the expanding number of vehicles (*Economic Survey 2009–10*).

The graph encapsulates the first major policy response to rising transport demand: 'keeping private motorized vehicles moving' through widening and flyover construction to reduce bottlenecks as and when they arise. The City Development Plan is investing more than half its transport budget into flyovers and road capacity enhancement schemes (Arora 2010).

4.2.2 Less Modal Choice Implies Higher Carbon Trips

A focus on road capacity enhancement contrasts significantly with two of the key objectives of the Ministry of Urban Development (2006), firstly, to establish an 'equitable allocation of road space' and secondly, to prioritize non-motorized and public transport. Harm is also caused to another key objective; to create a multimodal transport system. In Delhi, for instance, including public transport, more than three quarters of trips in the city involve a walk or cycle trip, as shown in Figure 4.2. Over 75 per cent of access and egress trips to Metro stations are 'non-motorized' (RITES Ltd and TERI 2010).
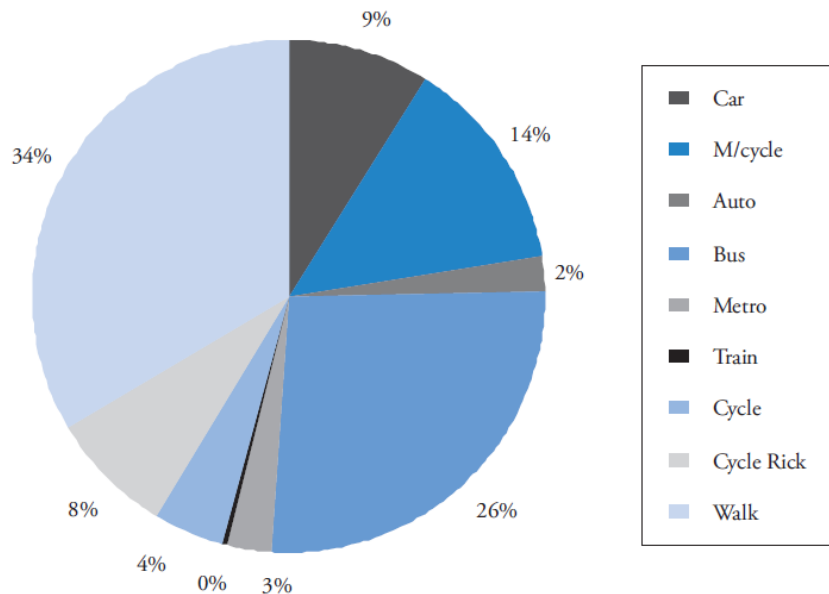
Figure 4.2 Low Carbon Transport Journeys in Delhi, 2008
Source: RITES Ltd and TERI 2010.

Preserving a high non-motorized share, especially for short distance trips of 5 km or less should be a priority in any low carbon transport strategy (55 per cent of trips in Delhi are less than 5 km). The table below, taken from the US Bureau of Energy Effi ciency, compares energy consumption of diff erent means of transport (see Table 4.1). Although there are caveats associated with comparing the energy consumption of different modes, not least in a different country, what is interesting to note is that ridership of a bus needs to be at least 10 passengers in order to consume the energy at a rate equivalent to an average car.

In Indian cities like Delhi the picture is more favourable to lower carbon bus use, with an average of 50 passengers using one at any given time, combined with the fact that all buses in Delhi run on CNG. However, carbon dioxide

Table 4.1 Comparative Fuel Efficiency of Different Transport Modes

Transport mode	Average passengers per vehicle	BTU per passenger-mile	MJ per passenger-kilometre
Vanpool	6.1	1,322	0.867
Efficient Hybrid	1.57	1,659	1.088
Motorcycles	1.2	1,855	1.216
Rail (Commuter)	31.3	2,996	1.964
Rail (Transit Light and Heavy)	22.5	2,784	1.825
Rail (Intercity Amtrak)	20.5	2,650	1.737
Cars	1.57	3,512	2.302
Air	96.2	3,261	2.138
Buses (Transit)	8.8	4,235	2.776
Personal Trucks	1.72	3,944	2.586
Cycle	1	183	0.12

emissions per passenger kilometre are still likely to be at least one fifth that of an equivalent averagely occupied car given the fact that average vehicle weight in Delhi is less than the US average.

Walking a kilometre, on the other hand, consumes only 0.330 MJ of food energy. Cycling uses even less energy, 0.12 MJ per km (183 BTU/mi), less than a quarter of the energy needed to carry a passenger one kilometre by bus in Delhi.

Walking (or cycling) to Public Transport is Unsafe, Consumes Unnecessary Time and Eff ort

Presently 40 per cent of roads in the city do not have a pavement refuge and those that do exist are often unusable, especially by the mobility impaired due to extremely high kerb heights, encroachments, and obstructions (RITES Ltd and TERI 2010). Reported road deaths are another deterrent, topping 2000 a year, with the majority of victims being pedestrians (55 per cent). Road planning is undertaken by citywide agencies and the needs of local, as opposed to regional, road planning requirements are weakly addressed. Road crossing facilities are ripe for an upgrade; as is the need for behavioural change in drivers. Zebra crossings are routinely ignored and light controlled crossings that do secure adherence are few and far between; a penchant exists instead for hurdles to the mobility impaired like foot overbridges and subways that are now being removed in developed cities of the world in favour of accessible, street level crossings (see Figures 4.3(a) and 4.3(b)).

Figure 4.3(a) A Family Trying to Cross a Road to Change Bus **Figure 4.3(b)** Buses Don't Stop at the Stop

Source: Centre for Science and Environment Photo Library, 2009.

Though similar in geographical size to London, Delhi possesses approximately 750 pedestrian light controlled crossings compared to 6,500 in London. Vehicle movement is prioritized over public transport users by allowing 'free left turns' at most junctions. In this scenario, given a choice in travel mode, who is not likely to opt for a car or motorcycle?

Figure 4.4 showcases the effect of private vehicle based development, showing the impact of installing an elevated road in Ashram Chowk on the Ring Road in Delhi. Designed to reduce congestion by allowing signalfree movement, the road elevation makes local journeys nearly impossible to conduct by non-motorized means. Everyone is forced into a motorized vehicle even for short journeys and bus stops are difficult to reach too.

Buses are an Option of Last Resort

With worsening travel conditions for pedestrians, as also most other public transport users, the use of the bus is taking a nosedive. In the last eight years the number of person trips in Delhi has increased by 22 per cent. While the city has seen a marginal shift in person trips to the new Metro service, this has been more than cancelled out by a fall in the order of 17 per cent in the total number of trips in the capital that are taken by bus. In 2008, 46 per cent of trips were taken on public transport compared to 60 per cent in 2001. *Such trends are resulting in an increasingly poor level of service for motor vehicles too.* The level of service for public and privately owned

motorized vehicles is falling in Delhi, which a few salient statistics clearly show. According to a recent RITES Study (RITES Ltd and TERI 2010):

• Traffic speeds are now less than 30 kmh on 70 per cent of the road network,
• Traffic capacity is exceeded on 44 per cent of network
• On another 19 per cent of network 'nearly' exceeds capacity

A Losing Battle against Climate Change

In a study of 87 cities in India, which included analysis of cities of over 5 million population as a special category (Delhi, Bangalore, Kolkata, and Mumbai), Wilbur Smith Associates used a calibrated urban transport model to establish the possible implications. The study concluded that failure to make any improvement to the existing situation in these cities will lead to a continued decline in bus patronage, falling as low as 25 per cent of modal share by 2030 (Wilbur Smith Associates 2009).

At the same time average trip lengths will rise from around 10 km now to 15 km by 2030. This, combined with increasing number of trips per capita, implies that:
• The total number of kilometres travelled in these four megacities will treble over the next 20 years from over 2.5 billion kilometres per day to 7.6 billion kilometres.
• Road volume to capacity ratios will increase from 1.21 to 2.9, increasing incidences of gridlock to a severely strained network.
• An extra 1,231 kilolitres of fuel will be consumed each day leading to a 65 per cent increase in emissions compared to a scenario that envisages 'an adequate public transport system' in the city.

4.3 Vision 2021—Delhi Government's Multimodal Transport Strategy

So how can a multimodal transport system help to reverse this trend, improve transport efficiency, and reduce carbon emissions in the sector? The Delhi government has developed an integrated multimodal strategy to increase the modal share of public transport to 80 per cent by 2021 translating into another 10 million journeys (RITES 2005). Known as Vision 2021, the lynchpin of the approach is to

develop a citywide Metro service rivalling that of London in size, buttressed by a series of bus priority corridors covering nearly 300 km, Light Rail Transit, and Monorail. Since feasibility studies have emerged with very high unit costs for Light Rail and Monorail these are not covered in this paper.

Metro Focus

So far Metro development has had significant media support and public acceptance and has proceeded closely in line with its implementation schedule. Designed for corridors where passenger demand is typically expected to be higher than 25,000 passengers per hour, Phases I and II are nearly complete, covering 192 km of the 413 km envisaged by 2021.

The metro is expected to cater for two million trips a day by 2010, a little less than 10 per cent of the total daily trip demand recorded in the city. In effect 75 per cent of Metro users are believed to be car or motorcycle owners, the overall number of journeys catered for by Metro in the city therefore remains modest. It is not a 'silver bullet' to solve Delhi's increasing transport woes, but given its high capacity (carrying up to 25,000 passengers per hour in each route direction), eventual geographical scope, and unrivalled reliability, it can provide competitive journey times for longer distance journeys greater than 10 km (RITES 2005).
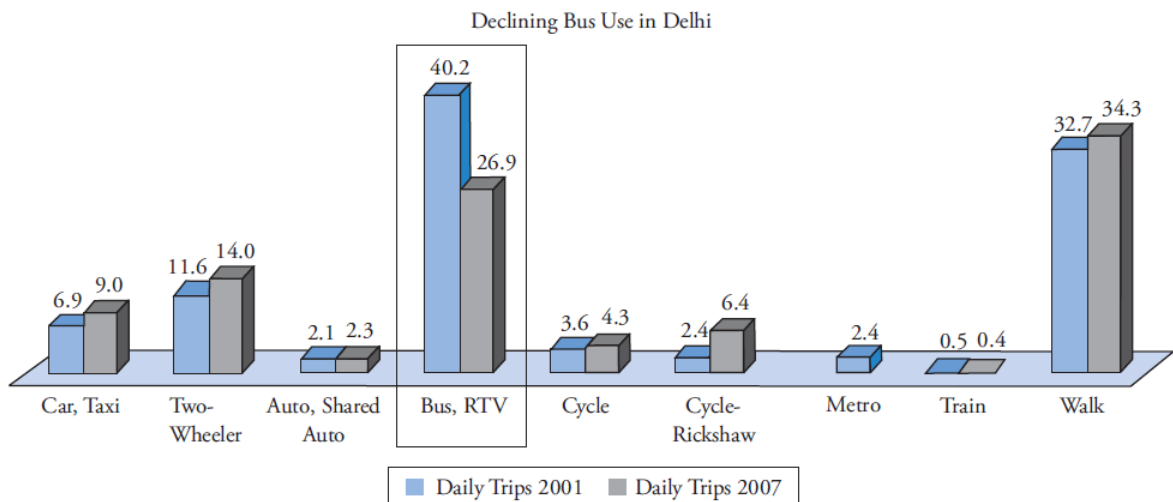
Figure 4.5 Declining Bus Use in Delhi, 2001–8

Note: Modal Split—Per cent of Person Trips in Delhi* (Figures in per cent).

Source: RITES Ltd and TERI (2010).

The Limits of Metro in a Multimodal Low Carbon Transport City

Yet an analysis of Metro networks in worldwide cities shows that the Metro faces considerable hurdles to ramping up its patronage to levels reaching 20 per cent of modal split. In Delhi actual Metro patronage is consistently less than figures predicated by advocates making a case for investment in this transport mode. With Phase II of the Delhi Metro nearly complete (126 km by June 2010 out of 189 km by September 2010), ridership hours around 5 per cent of all trips in the city (1.1 million), less than the number taken by cycle rickshaw. This compares with a 1995 prediction for over 3 million trips to be undertaken by the Metro on Phase I (65 km) by 2005 alone (Comptroller and Auditor General, India, 2010). The Metro is highly capital-intensive, costing INR 187 billion in the first two phases alone (DMRC 2008). Each passenger trip is subsidized to over Rs 100 (Mohan 2008). Nearly three quarters of the city's public transport budget for the City Development Plan currently finds its home in Metro expenditure but these loans are granted on the condition that ridership will eventually be high enough to pay them back. In this respect the Metro charges a rate of nearly Rs 3 per kilometre (Arora 2010). The Metro must compete with the door-to-door convenience and marginal cost of using a bus and a motorcycle which are Rs 1.25 and Rs 1 per kilometre respectively.

Climate also plays a role in limiting Metro catchments; 48 per cent of Delhi residents are beyond the 500 metre catchment area considered desirable to encourage use of public transport. Like many other cities in South Asia, for seven months of the year the soaring temperatures in Delhi are punishing. Evidence from temperate, western countries shows that people are unwilling to walk more than five minutes to a public transit stop, a factor which is increased for the Metro due to the extended time and eff ort in using steps and escalators to access and egress from the train. In a city like Delhi the 'willingness to walk' to public transit is, if anything likely to be much less and compounded by safety and access concerns highlighted earlier.

Car parks can be provided for vehicles, but these can only ever cater for a small number of the required number of metro passengers (2,000 or so long-stay commuter cars compares unfavourably with an *hourly* Metro capacity of 25,000 trips). Personal vehicle access to Metro stations is also likely to generate localized congestion, increase the overall carbon emissions for each journey, and can only serve one half

of the access or egress trip. Only 3 per cent of trips to Metro stations are currently by car, a figure that is not likely to change significantly in the near future.

Bus Travel in a Low Carbon Transport City

Whilst the Metro can offer time savings on longer distance trips where access and egress times form a smaller portion of the overall trip duration, the 'workhorse public transit system' in Delhi needs to be low cost to cater for a large cohort on low incomes (Delhi's average per capita income is still less than $6 a day), highly flexible with stops and stations close to people's homes and workplaces and able to cater for multiple origins and destinations with shorter trips. Traditionally, buses have been able to deliver these needs much better than fixed rail heavy transit systems.

Such a conclusion echoes a study of different cities in Latin America showing that Metro systems alone are not a sufficient means of effecting a modal shift. Despite having one of the largest networks in the world, the Mexico Metro caters for merely 14 per cent of journeys in the city. London, with a Metro network the size of Delhi's after completion handles an even lower proportion of trips.

Extensive use of more flexible public and para transit options including buses, combined with land-use planning measures to create an environment-friendly network for pedestrians and cyclists would appear to be more essential components to reduce car use and carbon emissions from transport (Mohan 2008; BRT Planning Guide 2008) (see Figure 4.6).
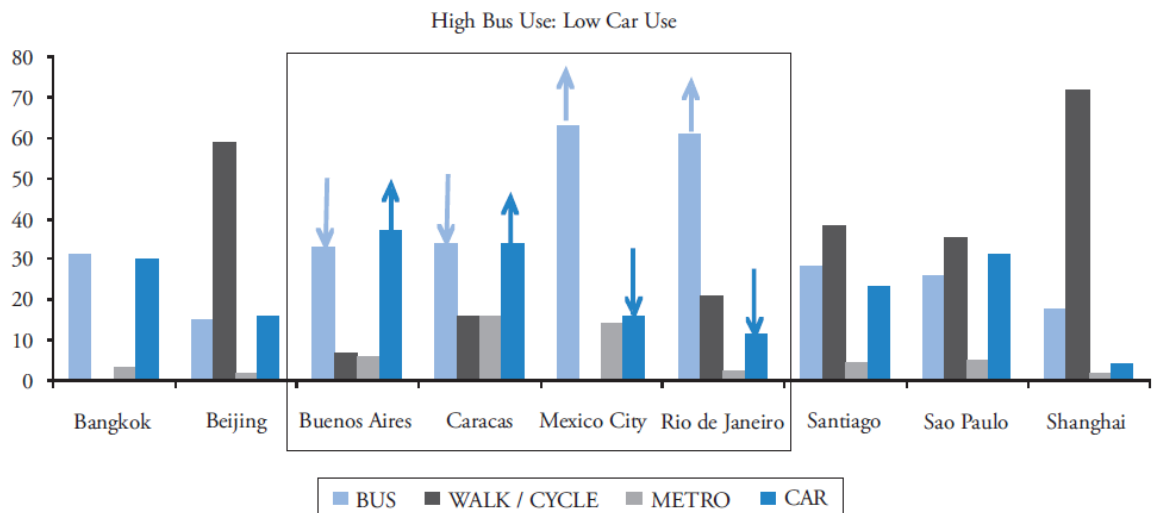
Figure 4.6 High Bus Use, Walking, and Cycling: Key Determinants of Reduced Congestion

Source: Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ) and SUTP (2008).

Demand Management and Bus Prioritization

Investing in a Metro network alone brings with it no particular requirement to increase the efficiency of the road network, to cater for more trip demand using less space and energy. In the absence of any multimodal strategy to manage demand for private vehicles and to prioritize public transport, walking, and cycling, Metro facilities open up more space for private vehicles, making cars and motorcycles more convenient to use. Studies for the Asian Development Bank provide an indication of the scale of possible carbon dioxide savings from a bus-based strategy in India, Bangladesh and Sri Lanka (ADB 2006):

• Bangalore: An increase in bus share from 62 per cent to 80 per cent saves equal to 21 per cent of the fuel consumed in the base case. This leads to 23 per cent reduction in total vehicles and frees up road space equivalent to taking nearly 418,210 cars off roads. Carbon dioxide emissions can drop by 13 per cent. Particulate matter (PM) can drop by 29 per cent and nitrous oxides (NOx) by 6 per cent.

• Dhaka: An increase in bus share from 24 per cent to 60 per cent saves fuel equal to 15 per cent of the fuel consumed in the base case. This frees up road space equivalent

to removing 78,718 cars from the roads. Carbon dioxide emissions drop by 9 per cent. PM can drop by 13 per cent and NOx less than 1 per cent.

• Colombo: An increase in bus share from 76 per cent to 80 per cent can save 104,720 tons of oil equivalent, or 3 per cent of the fuel consumed in the baseline case. This means a 5 per cent reduction in the total number of vehicles and frees up road space equivalent to removing 62,152 cars. (ADB 2006)

An Optimal Low Carbon Transport Strategy for Delhi

Using comparative risk assessment methodology researchers from Delhi and London carried out a study of five different greenhouse gas scenarios for a series of different transport investments in the two cities (The Lancet 2009).

The study compared policy action to improve vehicle fuel efficiency combined with rail-based improvements to the same in enhancement of the bus network, restrictions on private vehicles, and higher standards of connectivity, safety, comfort, and access for pedestrians and cyclists.

The Delhi study used data from VIBAT and Wilbur Smith Associates to establish a baseline scenario of global emissions from the transport sector in 2004 (6.1 million tonnes carbon dioxide) and extrapolated this first to 2010 and then onwards to 2030 (Scenario 1) when the sector is expected to emit 19.6 million tonnes of carbon dioxide. This is a 526 per cent rise on 1990 carbon dioxide emissions levels in Delhi from the transport sector.

The baseline was then adapted to three different policy scenarios. Scenario 2 parallels the Delhi government's CNG initiative when all public transit vehicles were required to shift to liquid petroleum gas fuel in 2002 and subsequent requirements for vehicles to meet international EURO IV standards. The scenario assumes compliance with Euro VI standards by 2020 in line with all European countries. Eff orts to up-scale the vehicle fleet are combined with significant investment to develop a citywide rail network like the Metro. The result for carbon dioxide emissions is a rise in the order of 447 per cent on 1990

levels, 73 per cent less than the baseline. Scenario 3 of the Lancet study, meanwhile assumes a reversal in declining conditions for non-motorized transport (NMT) in

Delhi, resulting in a marginal increase in walking trips and a doubling in the amount of cycle trips. Scenario 3 sees a halving in per capita carbon

dioxide emissions in transport in Delhi compared to Scenario 2, achieved through restrictions on vehicle usage, ranging from road pricing and tolling to the application of tighter parking controls. Delhi is transformed from a city in which cycling and walking are a mode of necessity for those unable to afford a motor vehicle to a mode of choice. Bus trips increase marginally in Scenario 3, bucking the current downward trend. There is a significant increase in rail usage, paralleling again rising Metro patronage in Delhi. Scenario 3 sees a rise in carbon dioxide emissions in the order of 234 per cent on 1990 levels, a little more than half the amount secured through a vehicle technology and Metro focused approach.

Finally, Scenario 4 links measures implemented in Scenarios 2 and 3, seeing an increase in 199 per cent on 1990 levels of carbon dioxide emissions from the transport sector, something like a doubling on levels emitted in 2004.

An important conclusion from the study is that *prioritization of walking and cycling and restricting vehicles through policy interventions like carbon rationing, road pricing, and traffi c demand management, combined with improving conditions for those using public transport (Metro and bus), would reduce emissions more than twice as much as those from a strategy focused solely on vehicle efficiency improvements and Metro development.*

The strategy also achieves important co-benefits such as better health and improved quality of life. Health benefits include lower levels of chronic disease such as Type II diabetes and heart disease due to a combination of less airborne pollution and a fitter, more active, healthy

	Aggregate Transport CO_2 Emissions	Transport CO_2 Emissions Per Person (tCO_2/person)	CO_2 Emissions Increase on 1990 (%)
2004 Delhi	6,146,651	0.4	97
2030 Scenario 1: BAU	19,550,693	0.8	526
2030 Scenario 2: Low Carbon Motor Vehicles (LCD)	17,069,668	0.7	447
2030 Scenario 3: Active Transport (AT)	10,458,736	0.4	235
2030 Scenario 4: Sustainable Transport (ST)*	9,327,207	0.4	199

Note: Delhi Population: 2004 = 14.8 million and 2030 = 26.0 million
* Sustainable Transport = LCD + AT

Table 4.2 Comparative Scenarios of Carbon Emission Mitigation Strategies in the Transport Sector, Delhi (2010–30)

Source: Public Health Benefits & Strategies to Reduce Greenhouse Gas Emissions: Urban Land Transport (The Lancet 2009).

population. Decreasing road traffic also has a potential to reduce road accidents, although the study was not able to quantify this effect.

Delhi Bus Rapid Transit

As part of the Vision 2021 investment strategy, a total of six Bus Rapid Transit Corridors are slated for development in Delhi, each with the kinds of pedestrian and cycle facilities envisaged in the Wright and Fulton paper. These may help to transform the image of bus transport in the city by improving the speed, comfort, and status of this mode of transport. They may also herald something of a cycling renaissance and serve as a benchmark for future pedestrian facilities in the city, according to international experts.

The Experience of Delhi's Pilot BRT Corridor— Ambedkar Nagar to Delhi Gate

One BRT is already in existence, a 14.5 km corridor running in South Delhi from Ambedkar Nagar to Delhi Gate, although only 5.8 km is currently operational. In contrast to the Metro, the Delhi BRT has been mired in controversy since it started in April 2008 despite witnessing an increase in bus patronage in the order of 10 per cent, bucking the citywide trend and a reduction in bus user travel time in the order of 33 per cent (Hidalgo and Pai 2009). In line with the Wright and Fulton study findings, another important benefit of the first corridor is the rising number of cyclists using its fully segregated lane. The number of cyclists using it has increased from 1,200 per hour to 2,800 during peak periods. BRT, despite the controversies that surround it, remains a potentially cost-effective means of transport investment. Its true benefits will only begin to be realized once it becomes part of a more capacious public transport network. In comparison to the Metro, the total cost of corridor construction was $48 million, an average of $3.3 million per kilometre. The

Delhi Metro ranged from $25 million to $60 million per kilometre. Although the Delhi Metro has the capacity to cater for 25,000 passengers per hour during the peak period, the Delhi BRT already carries up to 12,000 passengers per hour at less than one tenth the capital cost. A fully fledged BRT akin to that operational in Bogotá could see this fi gure rise to 40,000 passengers per hour.

Challenges to Establishing a BRT Network

Issues associated with public acceptance and cultural change (the requirement that motorized vehicles stop at mid-blocks as well as at junctions to allow bus passengers to access the stops) set significant challenges to the ultimate success of BRT in Delhi from the outset.

Journey times for car users have increased by 14 per cent since the corridor began (EMBARQ 2009). In purely textbook terms the first corridor might have fitted the bill for conversion to BRT; a large number of buses, cycles, pedestrians, and a high number of personal vehicles that were ripe for segregation. Politically, however, the corridor was challenging. Much of BRT's promised success rested on people being willing to switch to public transport to reduce dwell times in the mixed traffic lanes. That might have been possible if the whole network was able to capitalize on such an expectation. Despite the recent introduction of a new fleet of low-floor vehicles, outside the single BRT corridor buses remain stuck in traffic, unreliable, overcrowded and, overall a poor competitor to private vehicles that face subsidized parking costs and lower taxes than buses (see Corporatization of Private Stage Carriages in Delhi section below) (Narain 2009). Neither are there deterrent policy measures against using a car or motorcycle apart from congestion, something which experts acknowledge has a greater impact in effecting modal shift than supply side improvements alone (Dasgupta et al. 1994).

The government appears to remain a long way from asking the public to leave their vehicles at home and switch to the bus. Only 0.2 per cent of the City Development Plan is spent on raising public awareness on transport (Arora 2010).

A decision to now shift the second part of the BRT corridor for the final 7 km stretch from central lane to left lane operating could compromise operational efficiencies gained in bus speed and passenger throughput in the first corridor. There will be no physical segregation of the bus lane and it will almost certainly be shared with other

vehicles. Despite the initial plan to develop six corridors of BRT by 2010, it is unlikely that even the first corridor will be fully operational by this time.

With the bus operating in an unsegregated left lane, experts suggest that fleet size requirements will as much as double as bus speeds fall due to greater friction with pedestrians, hawkers, slow-moving vehicles, parked, and left-turning vehicles at the kerbside leads to higher levels of unreliability. Audits conducted by engineers, cyclists, and the Traffic Police, of the constructed cycle lane on the new section of corridor from Moolchand to Delhi Gate also show service disruption as the need to put bus stops on the left side causes breaks in footpath and cycle track continuity.

Complementing BRT—The Corporatization of Private Stage Carriages in Delhi

Delhi is working to improve integration within and between different modes of public transit, integrate fares and routes, and improve the availability of information for public transport users. The 'vehicle' to achieve this restructuring is known as 'The Corporatization of Private Stage Carriage Services Scheme'.

Status of Bus Services in Delhi

Presently around half the bus services in Delhi are provided for by private contractors who typically own a very small number of buses. Each contractor operates his or her bus on individual routes, competing against 60 per cent of buses served by the state operator, Delhi Transport Corporation, and other private operators. As a consequence, the system is highly inefficient, encourages unsafe driving practices, and delivers few 'network' benefits. Only individually remunerative routes are operated by private operators. Less remunerative routes are sometimes served by the state-run DTC. However, like many other state-run transport companies there are weak incentives to provide efficient services. Recently a Comptroller Auditor General (CAG) report found that less than three quarters of DTC kilometres are actually run, a figure that has been falling for a number of years.

Bus Network and Management Reform Measures

The corporatization scheme aims to group cohesive bus networks into 17 area-wide clusters, each of which will be run by one operator for a contractual period of 10

years. The number of routes operated will increase from an estimated 500 actually run now to 657, thereby bringing the network within 500 metres of every home in Delhi. With the aim of reducing unsafe driving practices the operator will be paid according to the number of kilometres he runs.

Performance-based Management System

Compared to the state-run DTC buses, however, final operator payments will depend on how each bus performs in accordance with a pre-determined timetable. Operators with 'No shows' and late buses will either forfeit their payment or be renumerated less than those arriving on time, serving passengers in line with a number of predetermined standards. Performance will be measured through an on-board GPS bus tracking system linked to a Central Control Room that records individual data.

Intermodal Integration

A smartcard system will enable passengers to 'touch in' and 'touch out' of each bus, ending the requirement for time-consuming cash transactions every time passengers interchange.

Information Integration

A journey planner is under development, presently piloted on over 200 buses using the Bus Rapid Transit corridor in Delhi, which will use mobile phone and internet technology to feed real-time travel information to bus users. The first bus cluster of 17 has already been awarded and a further four more are currently out for tendering.

Walking and Cycling in a Low Carbon Transport System

Greater attention to improving NMT facilities could have a serious impact on the Delhi transport sector's contribution to climate change as the Lancet study clearly showed. Even a shift from a bus to a bicycle or foot can reduce carbon dioxide emissions more cost-effectively than the introduction of fuel-efficient vehicle technology. Early morning and evening commuting trips could be made feasible

during summer months with the availability of better street infrastructure including high levels of tree shading, work showers, changing rooms, cycle parking, and a supportive management.

A number of different NMT initiatives are currently coming together under a combination of a pro-active stance taken by the Delhi Metro and the manager of Delhi's BRT corridor, DIMTS, and a desire to 'beautify' and 'streetscape' for the Commonwealth Games. The latter involves the application of new Pedestrian Design Guidelines which have adopted the highest possible standards for pedestrian facilities and are mandatory to follow (UT and TC 2009). Both cycle sharing and these new 'showcase' pedestrian and cycle infrastructure projects have the potential to demonstrate the role that an NMT could play in reducing carbon dioxide emissions in the city.

Cycle Sharing Schemes in Delhi

The first initiative is a cycle sharing scheme that involves installing hire bicycles near to BRT stops and Metro stations. The idea is that people could use this means of zero carbon transport to undertake a motorized public transport connecting trip or as an alternative to short distance journeys often undertaken by car or motorcycle.

The most successful international cycle sharing scheme is run by the advertising company, JC Decaux, in Paris for the municipal government, with other, smaller schemes in Lyon, Berlin, Vienna, and Barcelona.

In Paris a total of 20,600 bicycles are used every day by over 81,126 people. Even assuming that a modest 20 per cent of customers would have otherwise used a car to travel an average of 7.5 km (half now using a bus for 10 km and half using the cycle alone for 5 km) this is a reduction in vehicle kilometres in the order of 121,680, all that would have been driven in the central urban area and most at peak travel times when carbon dioxide emissions per passenger km would have been at their highest due to high levels of congestion (Schlebusch 2010). Ignoring the scale differences between the two schemes for a moment, an examination of the utilization rate and the fare structure shows that Delhi's scheme is not currently securing maximum usage of its cycles, many remain parked in outlying areas to be returned only when the user makes a return trip to the station The Paris scheme, on the other hand, has cycle

stations installed at destination and origin points away from the public transit stop or station and provides a financial incentive for cycle sharers to utilize the bicycle for a short trip before it deposited at the drop off point. This enables the user to drop off the cycle thereby making it available for another user. The results are shown in the comparative

Figure 4.7 Cycles for Hire Outside Delhi Metro Station and BRT Stop

Table 4.5 Comparative Assessment of Cycle Hire Schemes in Delhi and Paris, 2008

System/City	Paris	Delhi
Number of Bicycles	20,600	130
Number of Stations	1,451	13
Number of Daily Customers (Average)	80,126	150
Duration of Trip (Average)	18 mins	174 mins
Bicycle Occupancy Per Day (Average)	3.89	1.16
Fare Structure	Free—first 30 mins	Rs 10 first 4 hours
	1 Euro—31–60 mins	Rs 5 each extra hour
	2 Euro—61–90 mins	
	4 Euro—Each extra 30 mins	

Source: Schlebush (2010).

utilization rates of both schemes. Other advantages of the Parisian system that Delhi would do well to replicate include: easy booking option for cycles over the internet or by mobile, and a strong brand identity through the choice of a modern bicycle that is distinctive comfortable and attractive to ride.

Despite this, a survey of the Delhi Cycle Sharing Scheme conducted by the German Development Agency, GTZ shows that the scheme has great potential to substitute for short-distance trips by car and motorcycle. The user survey found that two thirds had an above average education level, an average income of up to Rs 5,000 per

month, and half-owned a car or a motorcycle but were not using it because 'a bicycle is (more) convenient (Schlebusch2010).

4.4 Conclusions

The potential role of small-scale, local transport schemes which provide travel options for those walking and cycling for short trips and as a means of accessing motorized public transport has not yet been realized in India as a very good means of reducing carbon dioxide emissions. Local planning is weak.

A transport network based on buses, para transit, and with greater attention placed on making streets pedestrian and cyclist-friendly will reduce carbon emissions more than a strategy focused on the Metro and improving fuel efficiency of vehicles alone. In the end the growing size of population in megacities in India is likely to mean that both strategies will be needed but presently investment is heavily skewed to heavy infrastructure whilst pavements, road crossings, cycle facilities, pedestrian, and public transport interchanges are neglected.

The argument that 'a good public transport system is needed before demand management measures can be introduced' does not hold. Measures are urgently needed to reduce the need to travel, increasing not only the supply of public transit but also the quality of public transport, while simultaneously introducing incentives to use it: higher parking charges, road pricing, equitable taxation between modes, etc.

Although many politicians and bureaucrats have been attracted to Bogotá as a successful model of how to achieve transport improvements while reducing carbon dioxide emissions, Bogotá worked because the Mayor, Enrique Penalosa, had a clear vision of what he wanted to achieve and stuck doggedly to the task despite powerful opposition from vested interests. A strong political leadership is an essential prerequisite for a multimodal transport system.

Greater capacity and skills needs to be developed amongst public agencies on how to design multimodal streets and roads. There is no programme to promote cycling and walking as 'responsible', 'high status' means of transport. Likewise rickshaws are banned on most roads. Quality standards for rickshaws are absent and these vehicles

are rapidly becoming antiquated and perceived as part of the problem rather than as part of the solution to transport woes.

4.5 Recommendations

• Creation of a Unified Metropolitan Transport Authority with responsibilities for land-use planning and transport investment with the mission of securing Transit Oriented Development through a new 'Road Users Act', a Transport Strategy and Plan that is fully funded, time-bound, and 'owned' by the Mayor.

• Re-balancing of investment in line with recommendations of the National Urban Transport Policy towards public transit, walking, and cycling and away from road capacity enhancement schemes in urban areas.

• In medium- to large-scale cities, higher levels of investment in Bus Rapid Transit and a faster approach to implementation involving the creation of a body, supported in law, solely responsible for BRT in the city.

• Modernization of bus vehicles focused on medium- to large-scale cities to be combined with structural reform to management of bus operations. Private corporations invited to run area-based franchises as part of a bus network better integrated with other walking, cycling, other buses, and Metro services. Private corporations to be a 'public sector comparator'. If public bus operations do not improve, privatize them.

• Creation of an NMT Centre of Excellence, part of the Urban Metropolitan Transport Authority (UMTA) mooted for Delhi and tooled with adequate funding to invest in cycle and walking infrastructure. Infrastructure planning only approved with cycle and pedestrian plans (at local and network planning levels).

• Standards of design to accord with those of the Pedestrian Design Guidelines set by the United Traffic and Transportation Centre (UTTIPEC) in Delhi and forthcoming Indian Cycle Design Guidelines based on Dutch CROW Cycle Design Manuals.

• A significant thrust towards greater road safety, including the development of targets for the NMT Centre of Excellence and targets for the Traffic Police to reduce road casualties while increasing cycling and walking mode share. Traffic Police to be re-named 'Transport Police'.

• Local bodies to be consulted on measures to improve road safety in their area and to be involved in smallscale, adequately resourced local transport (walking/ cycling/public transport access) audits, improvement, and road safety schemes.

• Introduction of a suitable methodology and plan to alter streets in line with the Pedestrian Design Guidelines: better quality street furniture, including tree shading, spaces for hawkers to provide road users with refreshments, spots to congregate, and take a breather away from traffic.

• Introduction of demand management schemes to encourage use of public transport, walking and cycling such as road pricing, stricter parking control, and removing subsidies on fuel and parking.

• As investment in public transport, walking and cycling facilities grow, with greater eff orts to explain policy changes to the public through a series of carefully targeted campaigns.

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